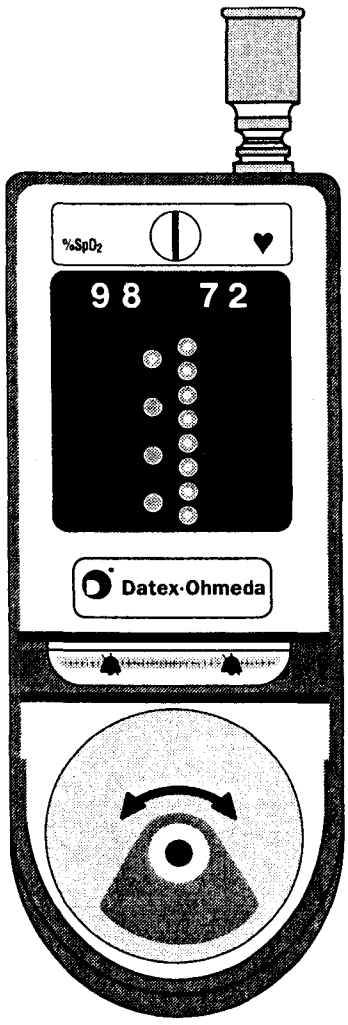
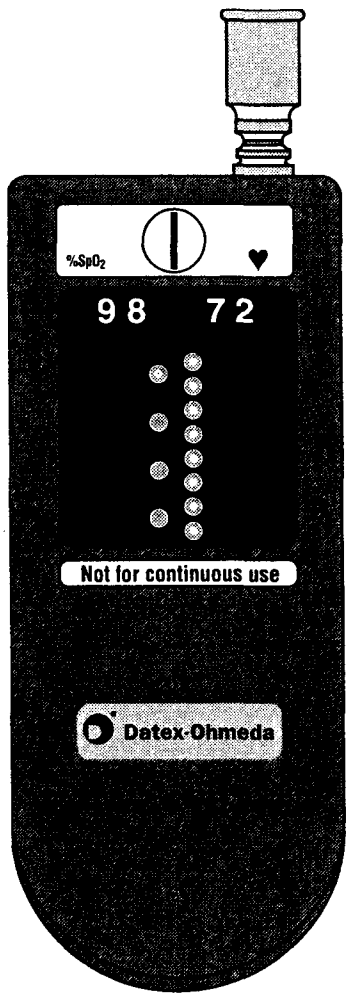
Datex·Ohmeda

3770/3775 Pulse Oximeter

Service Manual





6050-0004-915
Printed in USA

Datex·Ohmeda

3770/3775 Pulse Oximeter

Service Manual

Important

This manual is subject to periodic review, update, and revision. Customers are cautioned to verify that the manual's information applies to the software and hardware present in the equipment.

This product performs as described in this manual, and in accompanying labels and/or inserts, when assembled, operated, maintained, and repaired in accordance with the instructions provided.

This product must be cleaned and checked periodically. Do not use a defective product. Parts that are broken, missing, plainly worn, distorted, or contaminated should be replaced immediately. If repair or replacement become necessary, call or write to request service advice from the nearest Ohmeda Distribution and Service Center (inside the USA) or the nearest Ohmeda representative (outside the USA)—information is listed on the back cover. Do not repair this product or any of its parts other than in accordance with written instructions provided by Ohmeda and by Ohmeda-trained personnel.

The product must not be altered without the prior written approval of Ohmeda's Safety Department. The user of this product shall have the sole responsibility for any malfunction that results from improper use, faulty maintenance, improper repair, unauthorized service, damage, or alteration by anyone other than Ohmeda.

The safety, reliability, and performance of this device can only be assured under the following conditions:

- If the device has been used according to the accompanying operating instructions.
- If fittings, extensions, readjustments, changes, or repairs have been carried out by Ohmeda's authorized agents.
- Battery charger—if it is used in buildings that have ground equalization wiring that complies with relevant IEC or local standards and regulations (ETL, UL, CSA, PSI, TUV, etc.).

Trademark acknowledgements

Ohmeda is a registered trademark of The BOC Group
ClipTip and FlexConnect are trademarks of Ohmeda, Inc.
OxyLead and OxyTip are registered trademarks of Ohmeda, Inc.

Cidex is a registered trademark of Johnson & Johnson
Duracell is a trademark of Duracell, Inc.
Eveready is a trademark of Eveready Battery Company, Inc.
Formula 409 is a registered trademark of Clorox Company
Hewlet Packard is a registered trademark of Hewlett-Packard Co.
Kodak is a trademark of Eastman Kodak Company
Panasonic is a trademark of Panasonic Industries, Co.
Rayovac and Renewal are registered trademarks and Reusable Alkaline is a trademark of Rayovac Corporation
Top Crest is a trademark of Safeway, Inc.
Windex is a registered trademark of The Drackett Company

Text revised April, 1997

Table of Contents

1/Overview

2/Messages and Troubleshooting

3/Repair Procedures

4/Analog Board

5/Digital Board

List of Figures

1/Overview

This manual contains instructions for servicing the Ohmeda 3770 and 3775 Pulse Oximeters.

Note: The NiCd and AA battery packs, the single-station battery charger, and the Hewlett-Packard® (HP) printer are not serviceable accessories.

The content of this manual assumes you are familiar with how the unit operates, as described in the *3770/3775 Oximeter Operator's Manual.* General maintenance procedures contained in that manual, such as how to replace batteries in the AA battery pack, are **not** repeated in this manual.

You'll find detailed instructions for servicing and repairing the battery charger monitoring station in the *Battery Charger Monitoring Station Service Manual* (p/n 6050-0003-861). If you need to replace fuses or change the voltage selection for the monitoring station, refer to that manual.

This chapter contains:

- A general description of the oximeter and its functional components.
- Oximeter and battery pack specifications.
- Precautions, including specific warnings and cautions, you must follow when servicing the oximeter.
- Instructions for cleaning the oximeter, durable sensors, battery packs, and battery chargers.

Technical competence

Only trained and competent individuals who are experienced with medical devices of this nature should perform the procedures described in this manual to maintain or repair these devices. Use only genuine replacement parts, manufactured or sold by Ohmeda, for all repairs.

1.1 General description

1.1.1 Oximetry

Two models of the oximeter are available: the 3770 and the 3775. Both oximeters operate on power supplied by a battery pack. In addition, either oximeter, when a nickel-cadmium (NiCd) battery pack is attached, can be positioned in the battery charger monitoring station and operated using the station's DC (from AC mains) power supply.

The 3770 oximeter is designed specifically for spot checking SpO_2 and pulse rate. It has no alarms or user-definable parameters and is not intended for continuous monitoring.

The 3775 oximeter is a full-featured model designed for spot checking in addition to short- and long-term continuous SpO_2 and pulse rate monitoring. This model can print trend data, through an infrared link, to the optional Hewlett-Packard® (HP) printer.

Note: Throughout this manual, components and features available on both oximeter models and those found only on the 3775 oximeter are discussed. If you are working on the 3770, references to components specific to the 3775 do not apply.

General theory of operation

The oximeter uses a patented, two-wavelength pulsatile system—red and infrared light—to distinguish between oxygenated (O_2Hb) and reduced (HHb) hemoglobin, each of which absorbs different amounts of light emitted from the oximeter sensor. The system then calculates the relative percentage of these two constituents and SpO_2. The fractional saturation is determined by dividing the oxyhemoglobin by the total hemoglobin, represented mathematically as

$$\frac{O_2Hb}{Hb_{\text{total}}}$$

(i.e., the percentage of the total amount of hemoglobin carrying oxygen).

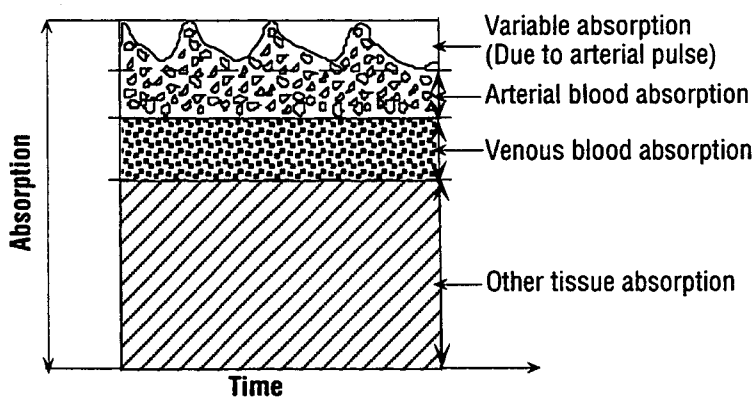


Figure 1-1. Signal composite

Arterial blood pulsation at the test site modulates the oximeter sensor's light. Since other fluids and tissues present generally don't pulsate, they don't modulate the light passing through that location. The reduction of light energy due to arterial blood flow is detected and isolated by using the pulsatile portion of the incoming signal.

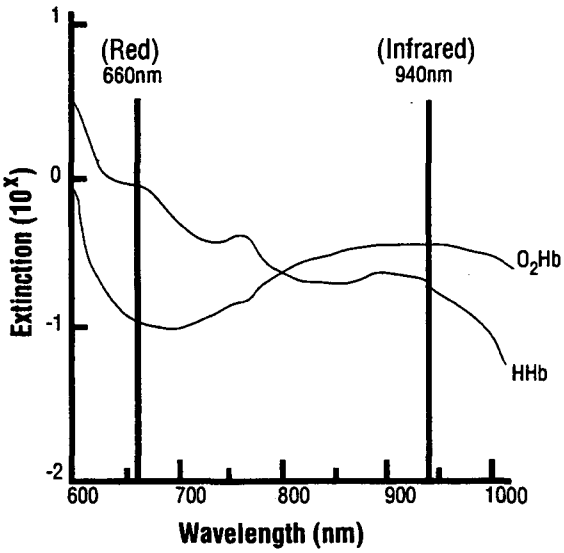


Figure 1-2. Extinction vs. wavelength

The sensor's photodetector converts the light, which is partially absorbed and modulated as it passes through the tissue sample, into an electronic signal. Since O_2Hb and HHb allow different amounts of light to reach the photodetector at the selected wavelengths, the electronic signal varies according to the light source that is "on" and the oxygenation of the arterial hemoglobin. Analog and digital signal processing then converts the light-intensity information into SpO_2 and pulse rate values for display on the monitor.

Calibration

In fractional mode, the fractional saturation is determined by dividing the oxyhemoglobin by the total hemoglobin, represented mathematically as

$$\text{Fractional } SpO_2 = \frac{O_2Hb}{Hb_{TOTAL}}$$

(i.e., the percentage of the total amount of hemoglobin carrying oxygen).

The calculation of SpO_2 assumes 1.6% carboxyhemoglobin (COHb), 0.4% methemoglobin (MetHb), and no other pigments. Appreciable variation from these values will influence SpO_2 accuracy. These values are based on the Ohmeda Pulse Oximeter Empirical Calibration Study.

1.1.2 Functional components

Figure 1-3 illustrates the relationship between each functional component.

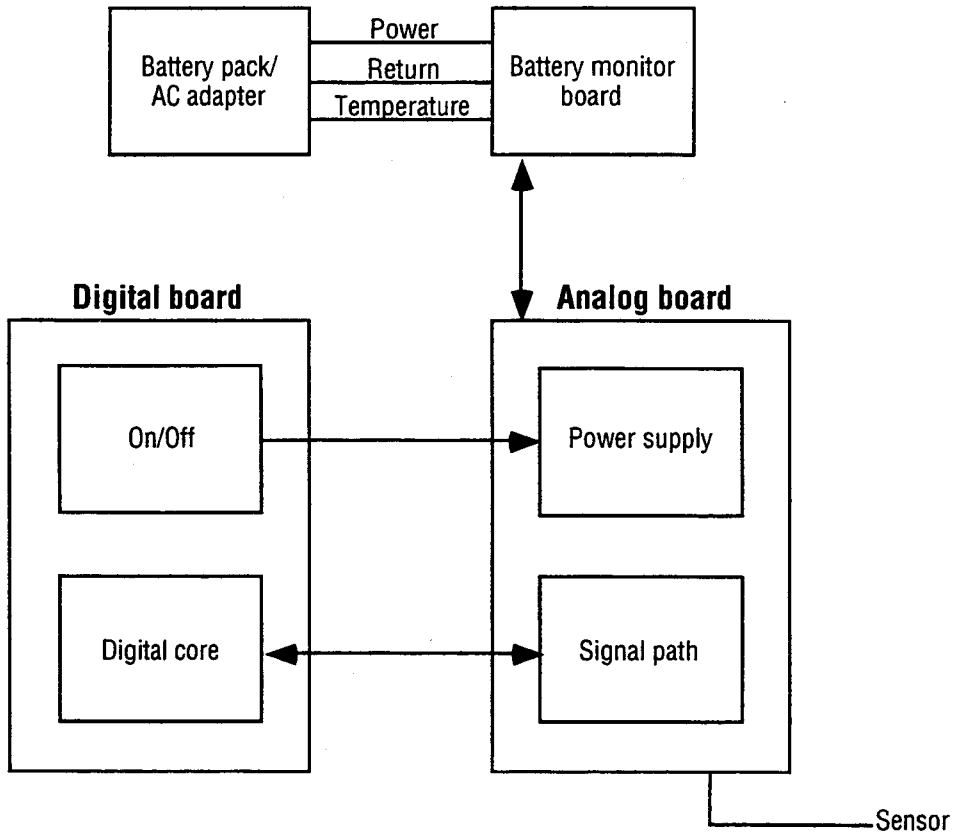


Figure 1-3. System block diagram

A complete oximetry system requires a digital board and an analog board. The digital board provides signal acquisition, numerical processing, and user interface for the oximeter. The analog board amplifies and conditions the biological signal. The digital board then samples the conditioned signal, performs the oximetry algorithm, and displays the results on numeric and graphic LED displays.

The user interface features an eight-character dot-addressable LED display, a 24-segment LED driver, a variable frequency audio driver, and (for the printer option) an infrared wireless transmitter.

For theories of operation and schematics, refer to the chapters listed below:

- 4/Analog Board
- 5/Digital Board

1.2 Specifications

Unless otherwise indicated, all specifications are nominal and are subject to change without notice. Unless otherwise indicated, the specifications below apply to both oximeters.

1.2.1 General

The 3770 or the 3775 when used with a LR6(AA) battery pack, a NiCd battery pack, or a NiCd battery pack in a battery charger monitoring station are referred to as the "system" for EMC purposes.

Electromagnetic effects
Indications that the system is experiencing electromagnetic interference include variations in the display (pleth bar does not correlate to physiological signals), sudden increases or decreases in the signal strength indicator that do not correlate to physiological condition of the patient, PROBE? messages that are not resolved by the instructions found in the *3770/3775 Oximeter Operator's Manual*, and the display of "rolling dots" when a valid physiological signal is present. This interference may be intermittent and careful correlation between the effect and its possible source is important. The system will not display any of these indications if it is used within its intended electromagnetic environment.

Environment: Suitable for use in the environment described in IEC 601-1-2.

EMC performance: The system complies with the requirements of IEC 601-1-2 (Electromagnetic compatibility - Requirements and tests). The following basic EMC standards were applied to verify conformance. The IEC 1000 series replaces the IEC 801 series referenced in IEC 601-1-2.

Emissions: CISPR 11 Group I, Class B

Immunity: IEC 1000-4-2, 8 kV air, 3 kV contact
IEC 1000-4-3, 3 V/m
IEC 1000-4-4, 2 kV power, 1 kV I/O
IEC 1000-4-5, 2 kV line to earth, 1 kV line to line

1.2.2 Oximeter

General

Dimensions
Height: 18.54 cm (7.3 inches; 9.5 inches including FlexConnect™)
Width: 7.62 cm (3.0 in.)
Depth: 5.33 cm (2.1 in.)
Weight: 0.33 kg (6 oz.) without battery pack

Power
Typical consumption: 1.6 W
Typical current: 180 mAmps

Circuitry

Microprocessor controlled
Automatic self-test at power on
Automatic setting of default parameters (3775 only)
Automatic alarm messages
Automatic/continuous system diagnostics

Visual displays and indicators

Main display: 8-character alpha-numeric; green; variable intensity dependent on ambient light conditions
Waveform display: 8 green LEDs
Signal strength indicator bar: 4 LEDs (1 dark green, 1 yellow green, 1 yellow, and 1 orange)
Low battery indicator: 1 orange LED
Alarm bar (3775 only): red
Display update interval: 0.5 seconds
Display hold interval: 12 seconds

Audio indicators (3775 only)

Alarm volume: On (default) and off
Pulse rate volume: On and off (default)
Pitch modulation to reflect changing SpO_2 levels
Alarm silence (120 seconds)
Low- and high-SpO_2 out-of-limits alarm
Sensor condition alarms
System failure alarms

Environmental

Operating

Temperature:	0 to 50 °C (32 to 122 °F)
Humidity:	0 to 95% RH, noncondensing
Atmospheric pressure:	8 to 15.4 psia (550 to 1,060 hPa)
Vibration:	Meets or exceeds— ASTM 4728, (Method C) MIL-STD-810E, Method 514.4, Section I.3.4.3 IEC 68-2-37
Drop/shock:	Meets or exceeds— IEC 68-2-32 (Procedure 1) MIL-STD 810E, Method 516.4, Section I.3.6 (Procedure IV)

Storage

Temperature:	–40 to 70 °C (–40 to 158 °F)
Humidity:	0 to 95% RH, noncondensing
Atmospheric pressure:	7.2 to 15.4 psia (496 to 1,060 hPa)
Vibration:	Meets or exceeds— ASTM 4728, (Method C) MIL-STD-810E, Method 514.4, Section I.3.4.3
Drop/shock:	Meets or exceeds— IEC 68-2-32 (Procedure 1) MIL-STD 810E, Method 516.4, Section I-3.6 (Procedure IV)

International Electrotechnical Commission classifications

Type of protection against electric shock: Internally powered equipment/Class II
Degree of protection against electric shock: Type BF
Degree of protection against ingress of liquids: Sprayproof (IEC529–IPX3)
Mode of operation: Continuous
Recommended methods of sterilization or disinfection: See "Cleaning procedures" in this manual and appropriate sections of the Ohmeda sensors' user instructions for recommended procedures for cleaning this equipment.
Degree of safety of application in the presence of a flammable anesthetic mixed with air or with oxygen or nitrous oxide: Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

SpO_2

Alarm limits (3775 only)

Low = 60 to 99%
High = 60 to 100%

Range 0 to 100%

Accuracy (1 standard deviation)—fractional calibration

90 to 100%	1.5%
80 to 89.9%	2.1%
60 to 100%	2.4%
Below 59.9%	unspecified

Interfering substances

Carboxyhemoglobin may erroneously increase readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substances containing dyes, that change usual arterial pigmentation may cause .erroneous readings.

Pulse rate

Range	40 to 235 beats per minute
Accuracy	±1.7% of current reading (accuracy calculations assume a constant pulse rate)

1.2.3 Battery packs

NiCd rechargeable battery pack

Weight:	0.43 kg (12.5 oz.)
Power:	9.6 V, sealed nickel-cadmium (8 cells)
Capacity:	1.4 A-hours
Operation time:	8 hours
Charge time:	2 hours
Life cycle:	1 year (500 cycles)

Low battery indicator LED illuminates when battery usage time is at or below ~15 minutes.

AA battery pack

Weight: 0.12 kg (4.4 oz.) without cells; 0.26 kg (9.3 oz.) with cells.
Capacity, operation time, charge time, and life cycle depend on the battery cell chosen.

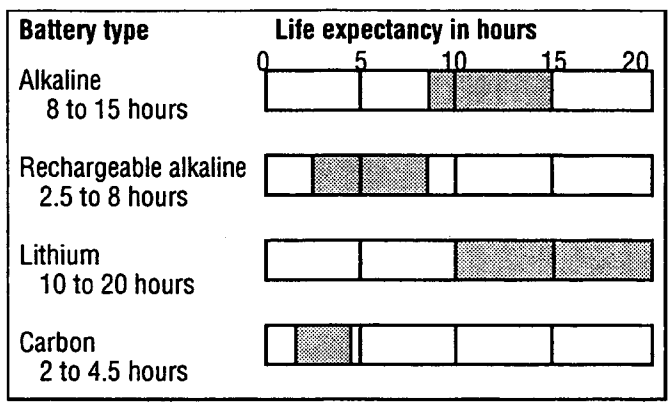


Figure 1-4. AA battery life cycles

Low battery indicator LED lights depending on the battery cell, as follows:

Alkaline	<2.5 hours
Alkaline rechargeable	<1 hour
Lithium	<1 hour
Carbon	<2 hours

Recommended brands:

Alkaline	**Lithium**	**Carbon**
Duracell ™	Eveready	Eveready
Eveready™		Rayovac
Kodak™		
Panasonic™		
Rayovac®, including rechargeable "Renewal®"		
Top Crest™		

Environmental—NiCd and AA

Operating

Temperature:	0 to 50° C (32 to 122 °F) – NiCd 0 to 40° C (32 to 104 °F) – AA
Humidity:	0 to 95% RH, noncondensing
Atmospheric pressure:	8 to 15.4 psia (550 to 1,060 hPa)
Vibration:	Meets or exceeds— ASTM 4728 (Method C) MIL-STD-810E, Method 514.4, Section I.3.4.3 IEC 68-2-37
Drop/shock:	Meets or exceeds— IEC 68-2-32 (Procedure 1) (NiCd) MIL-STD 810E, Method 516.4, Section I-3.6 (Procedure IV)

Storage

Temperature:	–40 to 50 °C (–40 to +122 °F)
Humidity:	0 to 65% RH (±20%) noncondensing
Atmospheric pressure:	7.2 to 15.4 psia (496 to 1,060 hPa)
Vibration:	Meets or exceeds— ASTM 4728 (Method C) MIL-STD-810E, Method 514.4, Section I.3.4.3
Drop:	Meets or exceeds— IEC 68-2-32 (Procedure 1) (NiCd) MIL-STD 810E, Method 516.4, Section I.3.6 (Procedure IV)

1.3 Default settings

Each time you power on the oximeter the following system default settings are in effect:

- Low-SpO_2 alarm limit = 85
- High-SpO_2 alarm limit = On
- Pulse beat volume = Off
- Alarm volume = On
- SpO_2 averaging interval = 12 seconds

Settings for time, date, and language are retained when the system is powered off as long as a battery is in place.

1.4 Precautions

Two types of precautions appear in this manual: warnings and cautions.

A **WARNING** indicates a potentially harmful situation that may cause injury to a patient or operator.

A **CAUTION** indicates a condition that may lead to equipment damage or malfunction.

Read this section fully and carefully before using or servicing the oximeter and its accessories.

1.4.1 Warnings

US federal and Canadian law restrict this device to sale by or on the order of a licensed medical practitioner.

Handling
Handle the oximeter and its accessories with care. Improper handling can cause damage or inaccurate operation of these devices.

Failure of operation
If the oximeter fails to respond as described (see "Checking normal operation" in chapter 3), do not use it until qualified personnel have corrected the situation or the unit has been serviced.

It is possible for any device to malfunction; therefore, it is the responsibility of the operator to verify any unusual data independently by doing a formal patient assessment.

Explosion hazard
Do not use the oximeter, the printer, or the battery chargers in the presence of flammable anesthetics or other flammable substances in combination with air, an oxygen-enriched environment, or nitrous oxide.

Cadmium is a hazardous substance. Dispose of a battery pack through an approved hazardous material disposal facility or by returning it to Ohmeda for reclamation.

- Do not dispose of a NiCd battery pack by throwing it in the trash.
- Do not incinerate or burn the NiCd battery pack.

Use only a 3770/3775 battery pack as part of the oximeter.

Use only an Ohmeda battery charger to recharge or condition an Ohmeda NiCd battery pack. Do not attempt to recharge or condition a NiCd battery pack that is not made by Ohmeda in an Ohmeda battery charger.

Do not expose a battery pack to any temperature that is hotter than you can tolerate to touch.

Electric shock hazard
An operator may perform only the maintenance procedures specifically described in the *3770/3775 Oximeter Operator's Manual.* Only qualified service personnel who are trained in the repair of this equipment should perform the procedures in this manual.

Do not attempt to repair the battery packs, the printer, or the single-station battery charger. They are not serviceable parts.

The battery chargers must be properly grounded.

- Connect this equipment only to a three-wire, grounded, hospital-grade receptacle. The three-connector plug must be inserted into a properly wired three-wire receptacle. If a three-wire receptacle is not available, a qualified electrician must install one in accordance with the governing electrical code.
- Do not under any circumstances remove the grounding connector from the power plug.
- Do not use extension cords or adapters of any type. The power cord and plug must be intact and undamaged.

Electrical shock and flammability hazard
Before cleaning or servicing the oximeter, always turn it off.

Before cleaning or servicing the printer, always turn it off and disconnect the power cord from the AC mains power supply.

Before cleaning or servicing the battery chargers, always disconnect the power cord from the AC mains power supply.

Fire hazard
To protect against fire hazard, replace the fuses in the battery charger only with fuses of the same type and local line voltage rating.

Patient safety
Do not, under any circumstances, perform any testing or maintenance on the oximeter when it is being used to monitor a patient.

The correct use of the oximeter is to measure only arterial oxygen saturation (SpO_2) and pulse rate.

- A pulse oximeter does not measure respiration and under no circumstances should it be used as a substitute for an apnea monitor.
- The oximeter must not be used as the primary monitor for infants being monitored for apnea, either in the hospital or in the home setting. It measures SpO_2 and pulse rate, and only then in conjunction with other appropriate monitoring techniques.
- A pulse oximeter is often used during sleep studies with adults, but must be used only to gather information regarding SpO_2 and pulse rate during these studies.
- A pulse oximeter is to be used only by or on the order of medically trained personnel.

This device is not intended for use in a magnetic resonance imaging (MRI) environment.

When the unit is operating on battery power and the battery becomes depleted, be aware that no alarm tone sounds when the unit shuts off.

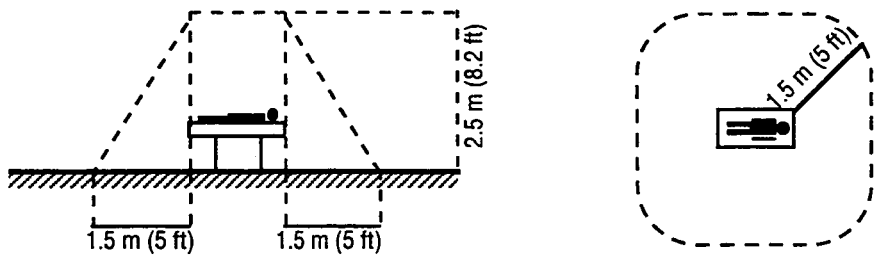
Patient safety—sensors
If a sensor is damaged in any way, discontinue use of that sensor immediately.

Prolonged monitoring or patient condition may require periodically changing the sensor test site. To reduce the risk of blistering, skin erosion, or ischemic skin necrosis, change the sensor site as specified in the user instructions for the sensor you are using. If any evidence of the above conditions appears before the specified period of time (for example, discoloration or reddening), change the site immediately.

To prevent patient injury or equipment damage, use only Ohmeda oximeter sensors approved for use with this oximeter (refer to the *3770/3775 Oximeter Operator's Manual).*

Refer to the user instructions for the sensor you are using for complete information, including warnings, cautions, and compatible oximeter connectors for that sensor.

Patient safety—printer
Do not use the printer within the patient environment as shown below:



Operator safety
Do not handle hot or leaking battery packs or batteries.

To protect yourself from possible electric discharge, avoid contact with the unit's internal components while performing any troubleshooting or repair procedure when the cover of the unit is removed and the unit is receiving power.

Data validity
To prevent erroneous readings, do not use an inflated blood pressure cuff on the same limb as the oximeter sensor.

Excessive ambient light, excessive motion, low perfusion, or electrical interference at the sensor site can result in the display of invalid SpO_2 data.

1.4.2 Cautions

Since printed trend data include the current date and time, to avoid any possibility of confusion do not change the date and/or time settings while collecting trend data.

Static sensitivity

The oximeter's electronic components are susceptible to damage by electrostatic discharge. When disassembling the unit.

- Work at a static-control workstation and wear a static-control wrist strap to discharge accumulated static charges from you and any tool you use.
- Use static-safe tools (tools with conductive or dissipative handles). Observe the safety precautions associated with using conductive tools in a high-voltage environment.
- Handle circuit boards (replacement and defective) by their nonconductive edges. Use antistatic containers to transport them.

Battery packs

To prevent battery-pack damage:

- Handle battery packs with care.
- Never attempt to take a battery pack apart. Access only the battery compartment for replacing batteries in the AA battery pack.
- Never attempt to replace a cell in the NiCd battery pack. The set of eight cells are matched for capacity and improper operation could occur.
- Do not put a battery pack where it can be short-circuited by contact with metal objects, such as in a pocket with keys.
- Use only AA batteries recommended by Ohmeda in the AA battery pack.

Cleaning

- Do not autoclave, pressure sterilize, or gas sterilize the oximeter, the printer, the battery packs, or the battery chargers.
- Do not immerse the oximeter, the battery packs, the printer, or the battery chargers in liquid. The electronic circuitry can be short circuited, causing permanent damage.
- Use the cleaning solution sparingly. Excessive solution can flow into the device and cause damage to internal components.
- Do not touch, press, or rub the main display lens with abrasive cleaning compounds, instruments, brushes, rough-surfaced materials, or bring it into contact with anything that could scratch the panel.
- Do not use petroleum-based solutions or solutions containing acetone, ethanol, freon, trichloroethylene, or harsh solvents to clean the oximeter, the printer, the battery packs, the battery chargers, or any protective covering on these devices. These substances attack the devices' materials, and device failure may result.

When cleaning oximeter sensors, follow all warning and caution statements provided in the sensor user instructions, which may include:

- Do not soak or immerse the sensor in any liquid.
- Do not autoclave the sensor.
- Do not gas sterilize the Flex II sensor with ethylene oxide.
- Disposable sensors are intended for single-patient-use only; do not attempt to clean them in any way.

Printer
To avoid damage to the printer, use only an AC adapter recommended by and available from Ohmeda.

Sensors
Refer to the user instructions for the sensor you are using for complete caution information.

1.5 Cleaning procedures

1.5.1 Oximeter

CAUTIONS:

- Do not autoclave, pressure sterilize, or gas sterilize the oximeter.
- Do not immerse the oximeter in liquid. The electronic circuitry can be short circuited, causing permanent damage.
- Use the cleaning solution sparingly. Excessive solution can flow in the oximeter and cause damage to internal components.
- Do not touch, press, or rub the main display lens with abrasive cleaning compounds, instruments, brushes, rough-surface materials, or bring it into contact with anything that could scratch the panel.
- Do not use petroleum-based solutions or solutions containing acetone, ethanol, freon, trichloroethylene, or harsh solvents to clean the oximeter. These substances attack the device's materials, and device failure may result.

To clean the oximeter, wipe it gently with a soft cloth dampened with any of the following cleaning agents:

Warm water	Isopropyl alcohol
Liquid soap/mild detergent	Cidex®
Mild chlorine bleach solution	Windex®
Hydrogen peroxide solution	Formula 409®
Gluteraldehyde (4% or less)	

Never use: Acetone, butyl alcohol, denatured ethanol, freon, trichloroethylene

1.5.2 Durable sensors

To clean Ohmeda durable oximeter sensors, follow the instructions provided with the sensor you're using.

CAUTION: When cleaning oximeter sensors, follow all warning and caution statements provided in the sensor user instructions, which may include:

- Do not soak or immerse the sensor in any liquid.
- Do not autoclave the sensor.
- Do not gas sterilize the Flex II sensor with ethylene oxide.
- Disposable sensors are intended for single-patient-use only; do not attempt to clean them in any way.

Tests conducted by Ohmeda indicate that the durable sensors (ClipTip, FingerClip, FingerProbe, Flex II, and EarProbe) will withstand a minimum of 1,000 cleaning cycles (wipe down with the solutions listed) without adverse effects.

After cleaning a durable sensor, verify that it is functioning correctly. See "Checking normal operation" in chapter 3.

1.5.3 Battery packs and battery chargers

CAUTIONS:

- Do not autoclave, pressure sterilize, or gas sterilize the battery packs or battery chargers.
- Do not immerse the battery packs or battery chargers in liquid. The electronic circuitry can be short circuited, causing permanent damage.
- Use the cleaning solution sparingly. Excessive solution can flow into the device and cause damage to internal components.
- Do not use petroleum-based solutions or solutions containing acetone, ethanol, freon, trichloroethylene, or harsh solvents to clean these devices. These substances attack the devices' materials and device failure may result.

WARNING: Electric shock and flammability hazard—Before cleaning the battery chargers, always disconnect the power cord from the AC mains power supply.

Before cleaning the battery packs or battery chargers, disconnect them from any power supply. Then wipe them gently with a soft cloth dampened with any of the following cleaning agents (do not spray the agent directly on any device):

Warm water	Isopropyl alcohol
Liquid soap/mild detergent	Cidex®
Mild chlorine bleach solution	Windex®
Hydrogen peroxide solution	Formula 409®
Gluteraldehyde (4% or less)	

Never use: Acetone, butyl alcohol, denatured ethanol, freon, trichloroethylene

2/Messages and Troubleshooting

This chapter contains:

- Tables containing messages that may be displayed on the oximeter and conditions that may occur while using the oximeter.
- A list of the possible causes for the message or condition.
- Recommended actions for responding to the message or to correct the condition. These actions include troubleshooting procedures to help you determine what needs to be done to correct the condition.

The tables in this chapter include the instruction to *swap boards*. This means you should replace one board at a time with a like board you know is functioning correctly to determine which board has failed. In most cases you are instructed to start with a specific board.

Also included in the tables are references to *possible failure points*. This information suggests component areas on a specific board that may have caused the malfunction. To repair the unit, always replace the board. Do not attempt to repair the board at the component level.

2.1 Messages and conditions

3770/3775 Pulse oximeter

Message	Cause(s)	Recommended action(s)
BOOTCODE	The unit failed the power-on sequence of diagnostics.	Replace the digital board. See 3/Repair Procedures.
PRINT <XX (3775 only)	Trend is printing to the printer. XX represents the amount of time remaining (in minutes) to complete printing.	No action required.
PROBE?	The sensor is not attached or not properly applied.	Attach the sensor.
	The sensor is not connected to the oximeter.	Check the sensor site; make sure the sensor is properly applied. Connect the sensor cable to the FlexConnect sensor connector on the oximeter.
	The sensor is not compatible with the oximeter.	Use an Ohmeda sensor that is compatible with the 3770/3775 oximeters.
	The sensor has failed.	Use another sensor.
		If the PROBE? message is continuous, check the wiring contacts between the FlexConnect sensor connector and the analog board.
		If the condition persists, swap boards, starting with the analog board. Replace the failed board. See 3/Repair Procedures.
		Possible failure points: *Analog board* Analog path *Digital board* A/D converter
SERVICE (alternates repeatedly with an error code/type message).	The system or one of its components has failed.	**Note:** If this message occurs **during printing,** power the oximeter off and then on. If you can't restart printing and the message appears again, see below.
		Swap boards and replace the failed board. See 3/Repair Procedures.

3770/3775 Pulse oximeter (continued)

Condition	Cause(s)	Recommended action(s)
No display.	Unit not receiving power.	Make sure a battery pack is correctly inserted in the oximeter and press the on/off button on the front panel of the oximeter.
	NiCd battery pack needs recharging or AA pack needs new batteries.	Insert a charged battery pack.
	If using the battery charger to power the oximeter, the NiCd battery pack's contacts are not in contact with the power contacts in the battery charger.	Make sure the oximeter is inserted correctly in the battery charger. A beep sounds when correct contact is made.
		If the condition persists, swap boards, starting with the analog board. Replace the failed board. See 3/Repair Procedures.
Oximeter alpha-numeric display switches on/off continually.	Faulty battery pack.	Install a known functioning, fully charged battery pack. If the new battery pack corrects the condition, discard and recycle the failed pack.
	Defective components on analog or digital board.	If the condition persists, swap boards, starting with the analog board. Replace the failed board. See 3/Repair Procedures.
		Possible failure points: *Analog board* Power supplies *Digital board* Power on reset (POR)
SpO_2 displayed value flashes.	The low SpO_2 or high SpO_2 alarm limit has been violated.	Flashing ceases when the alarm condition is cleared. Make sure the alarm limit is within the high and low limits.
Low battery light flashes every three seconds.	This alert indicates that not much full-power time remains on the batteries.	Remove the battery pack and replace it with a new, fully charged NiCd pack or AA pack with new batteries.
		NiCd pack only—Recharge the battery pack by itself or by placing it, together with the oximeter, into the battery charger.
Signal strength indicator and waveform bar LEDs darken, then "rolling dots" appear in the main display.	Loss of signal quality has occurred. Low perfusion, electrosurgery device, or other interference has been detected.	Check sensor site. Increase perfusion or relocate sensor. Remove any other device that may be causing signal interference.

3770/3775 Pulse oximeter (continued)

Condition	Cause(s)	Recommended action(s)
Oximeter sounds a constant tone.	Oximeter component failure.	Swap boards, starting with the digital board. Replace the failed board. See 3/Repair Procedures. Possible failure points: *Digital board* Microprocessor Speaker External guard dog *Analog board* Power
Can't access menus (3775).	Faulty component or area on the analog board.	Replace the analog board. See 3/Repair Procedures. Possible failure point:: *Analog board:* Rotary encoder assembly
Oximeter is not functioning at all.	Faulty battery pack.	Install a known functioning, fully charged battery pack. If the new battery pack corrects the condition, discard and recycle the failed pack. Possible failure points: *Analog board* PETE; Power supplies *Digital board* On/Off circuit; Power on reset (POR)

Printer

Condition	Cause(s)	Recommended action(s)
Printer won't print.	Printer not powered on.	Make sure the printer AC adapter is properly connected to the printer and to the AC power supply. Slide the I/O printer button to I (on).
	No data in the trend buffer.	No action required. No data to print.
	Printer and oximeter are not properly aligned; transmission is not being received at the printer.	Make sure the printer and oximeter are properly positioned for infrared transmission. See "Print mode" in 2/Operations of the *3770/3775 Oximeter Operator's Manual.*
	Printer malfunction.	Replace the printer. If the new printer corrects the condition, discard the failed printer. The printer is not a serviceable part.
		If the condition persists, the oximeter is malfunctioning. Swap boards, starting with the digital board. Replace the failed board. See 3/Repair Procedures.
Printer prints the symbol that represents lost information: 	Printer cannot print fast enough to keep up with the data transfer rate of the oximeter. The printer battery power is running low.	Install new batteries. Always use AC power whenever possible.
Prints repeatedly over a single line.	Paper jam.	Pull paper out and reload.
Print head scans but no characters are printed.	Printer malfunction: defective print head assembly thermal control.	Replace and dispose of the malfunctioning printer. The printer is not a serviceable part.
Print head does not move while unit is powered on.	Printer malfunction: jammed print head assembly.	Replace and dispose of the malfunctioning printer. The printer is not a serviceable part.
Printer's red LED behind IR window is not lit when power is on.	Batteries are dead.	Install new batteries.
	No AC power.	Ensure that the AC adapter is plugged into the printer and into the AC power source.
	Malfunctioning AC power adapter.	Check/replace the AC power adapter.
	Printer malfunction.	Replace and dispose of the malfunctioning printer. The printer is not a serviceable part.

Battery charger monitoring station

Condition	Cause(s)	Recommended action(s)
Battery charge status indicator is a steady red light after a battery pack is inserted.	The NiCd battery pack is above or below the allowable temperature charging range.	The charger will automatically start charging with a flashing green light when the battery pack reaches the proper range.
Battery charge status indicator is not lit after battery pack is inserted.	Oximeter and/or NiCd battery pack is not inserted into the charger correctly.	Reinsert the oximeter and/or NiCd battery pack, aligning it so you can hear a beep from the charger station and the light is lit.
	NiCd battery pack is not in place on the oximeter and/or in its slot in the monitoring station.	Install a NiCd battery pack on the oximeter and reinsert it.
	Voltage selected for the charger does not match the available local voltage.	Remove voltage selection drum and set correctly. Refer to the *Battery Charger Monitoring Station Service Manual.*
	NiCd battery pack is completely dead.	Replace NiCd battery pack with a new one.
Battery charge status indicator is a steady yellow light after a battery pack is inserted.	The NiCd battery pack is above or below the allowable voltage charging range.	The charger will automatically start charging with a flashing green light when the battery pack reaches the proper range.
	The battery pack may be fully charged already.	Remove the battery pack from the charger.
Battery charge status indicator is a flashing yellow light after a battery pack is inserted.	Charger is in conditioning mode.	The charger will automatically start charging with a flashing green light when the discharge cycle is complete.
	Faulty conditioning switch or malfunctioning circuitry.	The monitoring station requires service. Refer to the *Battery Charger Monitoring Station Service Manual.*
Green power light is on but there is a continuous beep.	Voltage selection drum in the power module is not set for correct voltage.	Remove voltage selection drum and set correctly. Refer to the *Battery Charger Monitoring Station Service Manual.*
Charger is "chirping."	Voltage selection drum in the power module is not set for correct voltage.	Remove voltage selection drum and set correctly. Refer to the *Battery Charger Monitoring Station Service Manual.*

Battery charger monitoring station (continued)

Condition	Cause(s)	Recommended action(s)
Green LED power indicator is not lit. Unit is not functioning.	Monitoring station is not connected to AC power.	Ensure that the power cord is plugged into the monitoring station and the AC power source.
	Fuse(s) are blown.	Replace the fuse(s) in the power inlet module. Refer to the *Battery Charger Monitoring Station Service Manual.*
	Voltage selection drum in the power module is not set for correct voltage.	Remove the voltage selection drum and set correctly. Refer to the *Battery Charger Monitoring Station Service Manual.*
	Damaged contacts.	Inspect the contacts.
		If the fuses, voltage selection setting, and contacts are not causing the condition, open the charger and troubleshoot from inside. Refer to the *Battery Charger Monitoring Station Service Manual.*
Charger is functioning but slot not charging or conditioning as expected.	Damaged contacts.	Inspect the contacts. All four prongs should protrude equally. If not, replace the contacts. Refer to the *Battery Charger Monitoring Station Service Manual.*
	If the LED stays at steady yellow when charging batteries, the battery pack may already be fully charged.	No action is required.
	When conditioning batteries and the LEDs don't go to flashing yellow, the conditioning switch may be faulty.	Replace the conditioning switch. Refer to the *Battery Charger Monitoring Station Service Manual.*
Charger is not functioning at all.	Fuse(s) are blown.	Replace the fuse(s) in the power inlet module. Refer to the *Battery Charger Monitoring Station Service Manual.*
	Voltage selection drum in the power module is not set for correct voltage.	Remove the voltage selection drum and set correctly. Refer to the *Battery Charger Monitoring Station Service Manual.*
	Damaged contacts.	Inspect the contacts.
		If the fuses, voltage selection setting, and contacts are not causing the condition, open the charger and troubleshoot from inside. Refer to the *Battery Charger Monitoring Station Service Manual.*

Battery charger (single)

Condition	Cause(s)	Recommended action(s)
Battery charger status indicator is not lit after a battery pack is inserted.	NiCd battery pack is not inserted correctly.	Reinsert NiCd battery pack.
	Damaged contacts.	Inspect contacts. All three prongs should protrude equally. If contacts are broken, discard charger. The charger is not a serviceable part.
	Yellow LED is burned out.	Discard charger.
	Internal failure.	Discard charger.
Battery charger status indicator is flashing slowly after a battery pack is installed.	The NiCd battery pack is above or below the allowable temperature or voltage charging range.	The charger automatically starts charging with a steady yellow light when the battery pack reaches the proper range.
	The battery pack may be fully charged already.	Remove the battery pack from the charger.
	Defective battery pack.	If the indicator continues to flash slowly, replace the battery pack..
Battery charger status indicator is flashing rapidly after a battery pack is inserted.	The battery pack may be fully charged already.	Remove the battery pack.
Green power indicator is not lit.	Charger is not connected to AC power.	Ensure that the power cord is plugged into the battery charger and the AC power source.
	Fuse(s) are blown.	Discard charger. The charger is not a serviceable part.
Green power indicator is flashing.	The battery pack is defective.	Remove and replace the battery pack.

3/Repair Procedures

This chapter contains:

- Ohmeda's repair policy and the procedures to follow for obtaining service.
- Safety procedures you must follow when handling equipment that may be contaminated and when making repairs.
- Procedures for inspecting the oximeter and replacing these parts:
  - Alarm bar
  - Analog board
  - Bezels
  - Digital board
  - IR lens
  - Menu select wheel and label
- Instructions for checking the normal operation of the oximeter.

This chapter also contains a list of service kits, a list of parts, and assembly illustrations for each oximeter.

3.1 Repair policy and procedure

Warranty repair and service must be performed by Ohmeda. Call the nearest Ohmeda Service Office listed on the back cover.

Do **not** use malfunctioning equipment. Have the unit repaired by Ohmeda. After repair, verify the unit is fully functional. Refer to "Checking normal operation" in section 3.4.

Only trained and competent individuals who are experienced with medical devices of this nature should perform the procedures described in this manual to maintain or repair these devices. Genuine replacement parts manufactured or sold by Ohmeda must be used for all repairs.

3.1.1 Obtaining service

In the USA: Contact the Ohmeda Service and Distribution Center, listed on the back cover of this manual, for assistance.

Elsewhere: Contact the nearest Ohmeda Representative or office listed on the back cover of this manual.

3.1.2 Packaging and return procedure

Please clean contaminated/dirty equipment before returning and make sure it is fully dry before packing it for shipment.

Package the equipment securely—in the original shipping container if possible—and enclose the following items:

1. A letter describing in detail any difficulties experienced with the oximeter.
2. Warranty information—a copy of the invoice or other applicable documentation must be included.
3. Purchase order number to cover repair if the oximeter is not under warranty, or for tracking purposes if it is.
4. Ship-to and bill-to information.
5. Person (name, telephone/Telex/fax number, and country) to contact for any questions about the repairs.

When Ohmeda's warranty is not applicable, repairs are made at Ohmeda's current list price for replacement part(s) plus a reasonable labor charge.

In the USA and Canada: Call the Ohmeda Service and Distribution Center for instructions on returning this product and then ship it prepaid to the following address:

Ohmeda Service and Distribution Center
7750 The Bluffs NW
Austell, GA 30001

Elsewhere: Call your local authorized service office as shown on the back cover of this manual and follow instructions for returning the oximeter.

3.2 Safety procedures

Read and follow **each step** of all test and repair procedures to ensure their proper and safe completion. Give special attention to all WARNINGS and CAUTIONS.

WARNINGS:
Patient safety—Do not, under any circumstances, perform any testing or maintenance on the oximeter or sensor when it is being used to monitor a patient.

Electrical shock and flammability hazard—Before cleaning or servicing the oximeter, always turn it off.

Before you start any procedure that involves disassembly of the oximeter, be sure to

- Power off and disconnect the unit from any power supply.
- Disconnect the sensor from the unit.
- Clean the unit—see section 1.5 in chapter 1.

After repairs are complete, verify that the device is functioning correctly—see section 3.4.

3.3 Inspecting the oximeter and replacing parts

For illustrations, refer to section 3.5.3 for the 3775 or to 3.6.3 for the 3770.

Follow the procedures in this section to inspect the oximeter for damage and replace defective parts.

CAUTION: Static sensitivity—
The oximeter's electronic components are susceptible to damage by electrostatic discharge. When disassembling the unit,

- Work at a static-control workstation and wear a static-control wrist strap to discharge accumulated static charges from you and any tool you use.
- Use static-safe tools (tools with conductive or dissipative handles). Observe the safety precautions associated with using conductive tools in a high-voltage environment.
- Handle circuit boards (replacement and defective) by their nonconductive edges. Use antistatic containers to transport them.

Tools and equipment

- #1 Phillips screwdriver
- Clear silicone rubber adhesive sealant (Dow Corning RTV 3145)

3.3.1 Disassembling the oximeter

Important: As you disassemble the oximeter, carefully set aside each part you plan to reinstall when you assemble the oximeter.

1. Turn off the oximeter and remove the battery pack.
2. Turn the oximeter face down and remove the four screws that secure the bottom bezel to the top bezel.
3. Remove the bottom bezel.
4. Inspect the top and bottom bezels. If either bezel is damaged, replace it during reassembly.
5. Inspect the interior for loose or broken parts and for foreign materials. Remove foreign material and note those parts that need replacement.
6. Grasp the connector for the FlexConnect™ sensor and lift up to loosen it from the top bezel.
7. **3770 oximeter:** Lift out the board set.
8. **3775 oximeter:**
   a. Remove the IR lens (plastic window).
      Note: If the lens is held in place with sealant, remove the lens only if you are replacing the lens and/or the top bezel **or** if the sealant is not intact.
   b. Turn the oximeter face up and gently pry off the menu select wheel.
   c. Remove the rotary encoder nut.
   d. Lift the top bezel off the board set.
9. To separate the analog and digital boards from each other, grasp the board set near the horizontal center and pull gently but firmly.
   3775 oximeter: Avoid stressing the ribbon cable and its connection to the analog board. Do not flex the ribbon cable any more than absolutely necessary.
10. If you plan to replace the alarm bar or the top bezel, turn the bezel face up and push the alarm bar through the bezel.

3.3.2 Replacing parts

When the oximeter is disassembled, you can replace any part listed below with a new part as you assemble the oximeter:

- Alarm bar
- Analog board
- Bezels
- Digital board
- IR lens
- Menu select wheel and label

3.3.3 Assembling the oximeter

Important: During the manufacture of some 3770/3775 oximeters, a bead of silicone sealant was applied to the IR window and sensor connector cutouts on the top and bottom bezels (see Figures 3-1 and 3-2). The sealant was applied to ensure the waterproof integrity of these oximeters.

You may need to reapply sealant during assembly if disassembly of the oximeter results in loss of the original sealant or if the sealant is no longer intact. Follow the instructions in this section to check the oximeter for the presence of sealant and, if necessary, reapply sealant.

1. Make sure the rotary encoder, FlexConnect wires, the power on/off switch, the alarm bar switch, all display and alphanumeric LEDs, and all other component parts are securely in place on their respective boards.
2. If you separated the alarm bar and top bezel during disassembly, position the alarm bar in the underside of the bezel, and press it into place.
3. Gently but firmly connect the analog and digital boards to each other.
4. Turn the top bezel face down. Place the board set into the top bezel with the digital board facing down.
5. **3775 oximeter:**
   a. Turn the oximeter face up.
   b. Place the rotary encoder nut on the rotary encoder and tighten it.
   c. Place the menu select wheel firmly on the encoder's stem.
   d. Turn the oximeter face down.
6. Push the FlexConnect sensor connector firmly into position in the top bezel.
7. Check the oximeter for the presence of sealant. If sealant is **not** present, go to the next step.
   a. If the sealant on the top bezel is not intact, apply new clear silicone rubber adhesive sealant (Dow Corning RTV 3145) to the top bezel above the sensor connector. See Figure 3-1.
   b. **3775 oximeter**: Add sealant in the IR lens cutout on the top bezel, if necessary.

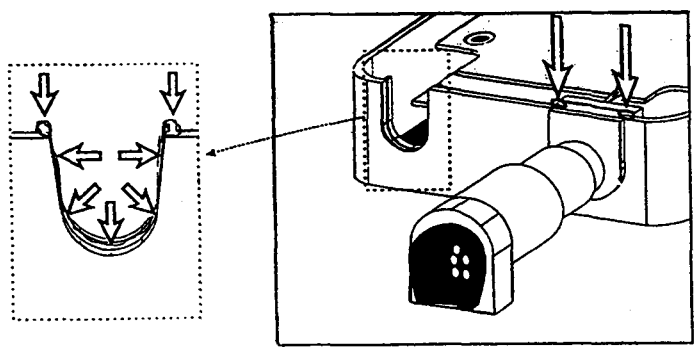


Figure 3-1. Applying sealant to the top bezel

c. If the sealant on the bottom bezel is not intact, add sealant to the sensor connector cutouts. See Figure 3-2.

d. **3775 oximeter**: Add sealant to the IR lens cutouts on the bottom bezel, if necessary.

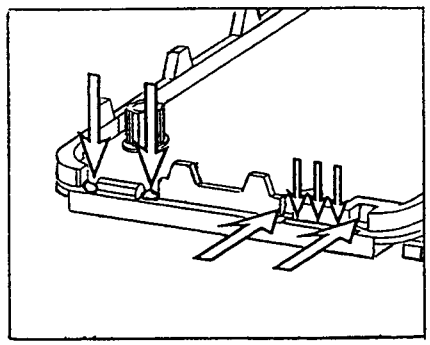


Figure 3-2. Applying sealant to the bottom bezel

8. **3775 oximeter:** Slide the IR lens into its slot on the top bezel.
9. Position the FlexConnect wires so that they will not be crushed between the ground ring on the analog board and the conductive boss that extends from the bezel.
10. Make sure there are no loose parts inside the top bezel. Then, place the bottom bezel on the top bezel and install the screws that connect the bezels:
    - For the 3770, use four 4-20 x 0.5L screws.
    - For the 3775, use four 4-20 x 5/8L screws.
11. Check the operation of the oximeter—see section 3.4 below.

3.4 Checking normal operation

1. Install a battery pack on the oximeter. Power on the oximeter and verify that the low-battery light is not lit.

   Note: No alarms sound for the first two minutes after powering on the unit.
2. Plug the OxyLead® or sensor cable into the FlexConnect™ sensor cable connector on the oximeter.
3. Place the sensor on a finger and wait until SpO_2 and pulse rate values appear in the main display.
4. Unplug the sensor cable from the oximeter and verify that the PROBE? message appears on the main display.
5. Plug the sensor cable back into the oximeter and wait for monitoring data to reappear on the main display.
6. Remove the sensor from the finger and verify that the PROBE? message appears on the main display.
7. Reattach the sensor to the finger. Verify that the signal strength is good to adequate (green or yellow signal strength indicator is illuminated).

   For more information, see "Data validity and signal strength" in the *3770/3775 Oximeter Operator's Manual.*

3.5 Oximeter assembly, 3775 (p/n 6050-0002-601, Rev. N)

3.5.1 Service kits, 3775

Kit, analog board, tested, 3775 6050-0003-667
PCA, analog board, 3775
Spacer, foam 0.25 x 0.125 x 0.75 in. (2)
Spacer, foam 0.50 x 0.125 x 1.0 in.
Spacer, foam 0.75 x 0.25 x 1.0 in.

Kit, digital board, tested, 3775 6050-0003-480
PCA, digital board, 3775

Kit, bezel, bottom, 3770/3775 6050-0004-078

Kit, bezel, top, 3775 6050-0002-889
Note: This kit does *not* include the alarm bar, on/off label, or wheel assembly.

Assembly, alarm bar 6050-0002-600

On/Off Label 6050-0002-593

Kit, wheel/label, 3775 6050-0003-666
Assy, wheel
Wheel/select label

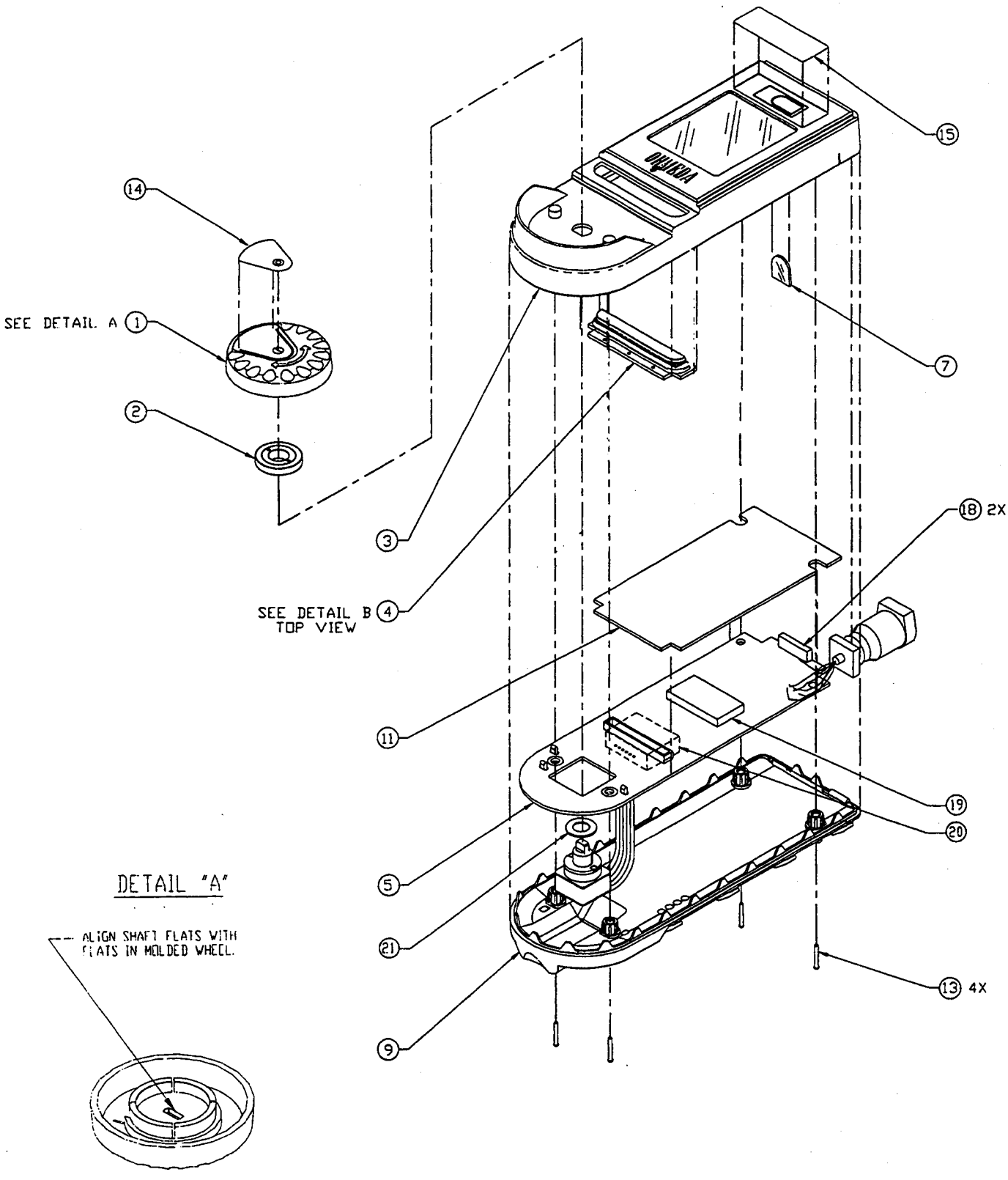
Kit, hardware, 3770/3775 6050-0003-780
Screw, tri-rnd, 4-20 x 0.5/8L (4)
Screw, tri-rnd, 4-20 x 0.5L (4)
Lens, IR

3.5.2 Assembly parts, 3775

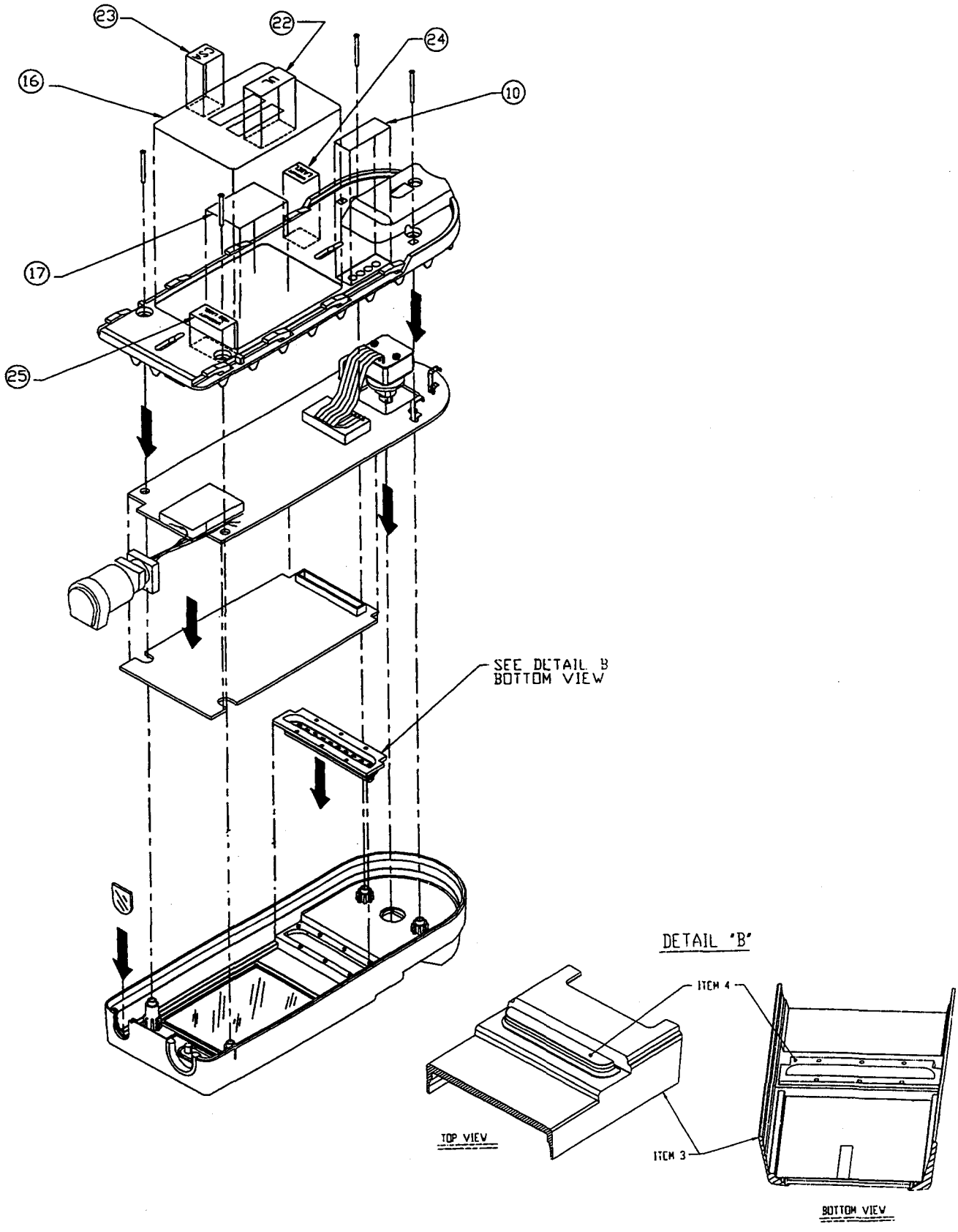
Each item number listed below identifies a component illustrated in section 3.5.3.

Item number	Description
1	Assy, wheel, 3775
2	Assy, nut, bearing
3	Assy, top bezel, 3775
4	Assy, alarm bar
5	PCA, analog board, 3775 *Includes:* Rotary encoder switch
7	Lens, IR, 3775
9	Bezel, bottom
10	Label, serial port
11	PCA, digital board, 3775 *Includes:* Speaker, 5 V, 0.354 inch diameter
13	Screw, tri-rnd, #4-10 x 5/8L, plastite (4)
14	Label, wheel/select
15	Label, on/off
16	Label, serial number/CE
17	Label, comp printer, Legitronic
18	Spacer, foam, 0.25 x 0.125 x 0.75 in. (2)
19	Spacer, foam, 0.50 x 0.125 x 1.0 in.
20	Spacer, foam, 0.75 x 0.25 x 1.0 in.
21	O-ring seal 0.354 in. ID , .040 in. wall
22	Label, UL 2601
23	Label, CSA
24	Label, date/3-year warranty
25	Label, warranty void, 3770/3775

3.5.3 Assembly illustration, 3775 (1 of 2)



3.5.3 Assembly illustration, 3775 (2 of 2)



3.6 Oximeter assembly, 3770 (p/n 6050-0002-632, Rev. G)

3.6.1 Service kits, 3770

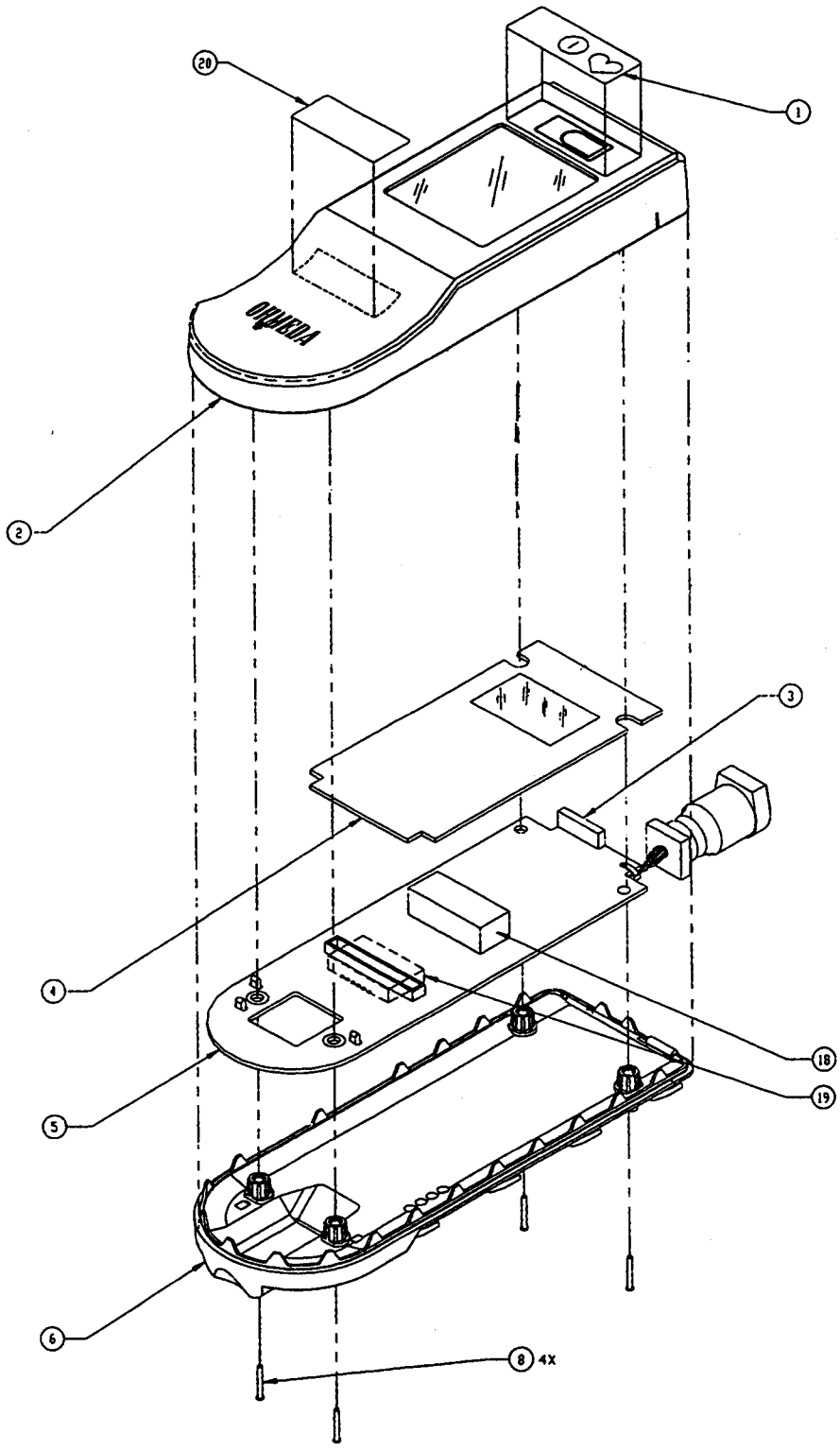
Kit, analog board, tested, 3770 6050-0003-486
PCA, analog board, 3770
Spacer, foam 0.25 x 0.125 x 0.75 in.
Spacer, foam 0.50 x 0.125 x 1.0 in.
Spacer, foam 0.75 x 0.25 x 1.0 in.
Kit, digital board, tested, 3770 6050-0003-481
PCA, digital board, 3770
Kit, bezel, bottom, 3770/3775 6050-0004-078
Kit, bezel, top, 3770.....6050-0002-886
Kit, hardware, 3770/3775 6050-0003-780
Screw, tri-rnd, 4-20 x 0.5/8L (4)
Screw, tri-rnd, 4-20 x 0.5L (4)
Lens, IR

3.6.2 Assembly parts, 3770

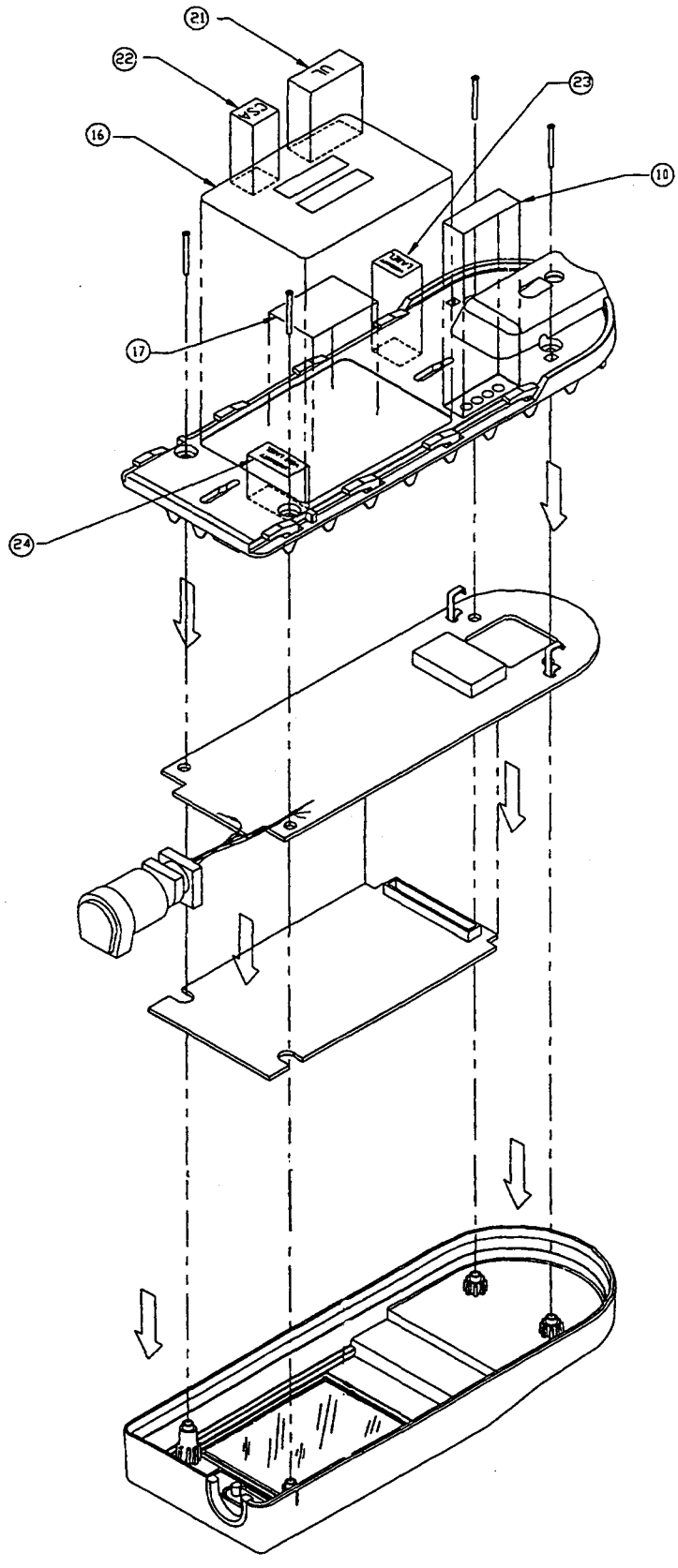
Each item number listed below identifies a component illustrated in section 3.6.3.

Item number	Description
1	Label, On/Off
2	Assy, top bezel, 3770
3	Spacer, foam, 0.25 x 0.125 x 0.75
4	PCA, digital, 3770
5	PCA, analog, 3770
6	Bezel, bottom
8	Screw, tri-rnd, #4-20 x 0.5L, plastite (4)
10	Label, serial port
16	Label, serial number/CE
17	Label, comp printer, Legitronic
18	Spacer, foam, 0.50 x 0.125 x 1.0 in.
19	Spacer, foam, 0.75 x 0.25 x 1.0 in.
20	Label, use warning, 3770
21	Label, UL
22	Label, CSA
23	Label, date/3-year warranty
24	Label, warranty void, 3770/3775

3.6.3 Assembly illustration, 3770 (1 of 2)



3.6.3 Assembly illustration, 3770 (2 of 2)



4/Analog Board

This chapter contains:

- A general description of the analog board.
- A system diagram.
- A list of analog board components.
- The analog board layout..
- The analog board schematic.

4.1 General description

Refer to Figure 4-1.

The oximeter's analog board provides the oximetry analog signal processing, sensor LED drive, detection of interfering signals, housekeeping and fault monitoring , standby and operational power, power switching, and battery interface. It also provides structural support for the digital board and the battery contacts. It contains attachments for the sensor connector, rotary encoder, and serial port. It also provides the grounding system for the case shield with EMC capacitors to shunt high-frequency currents.

Schematic overview

Refer to section 4.4 (1 of 15).

The schematic overview shows a block/interconnect diagram with connections for the sensor, rotary encoder, and battery pack. It also shows the 80-pin connector which interfaces with the digital board.

The 80-pin board-to-board connector contains signals shared by the analog and digital boards: power supplies, rotary encoder signals, oximetry timing and control, and many ground connections.

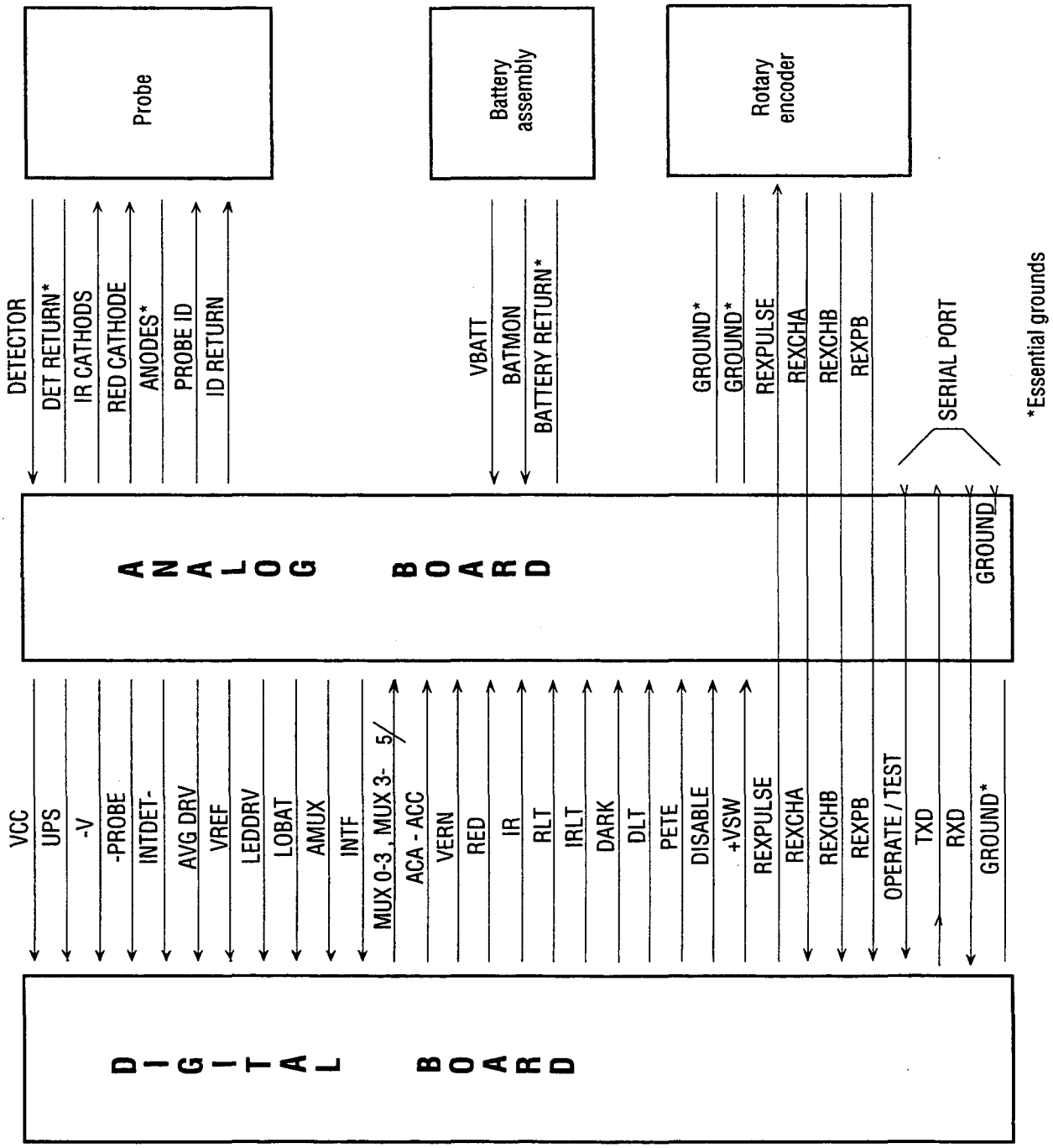


Figure 4-1. System diagram

4.2 Analog board components 6050-0002-599 (3770) & 6050-0002-596 (3775)

Designator	Description
Capacitors	
C1, 101	Cap, CER 50V 10% 120PF X7R 0805
C2, 8	Cap, CER 50V 5% 10PF 0805 NPO
C3, 4	Cap Tant 22µF 6.3V 3528 20%
C5, 6, 140, 141, 149	Cap, CER 50V 10% 1000PF X7R 0805
C7, 13, 37, 105	Cap, Tant 10V 20% 4.7µF
C9, 10, 12, 14 28, 29,148,152	Cap, Tant 10V 10% 4.7µF 3528
C11, 106	Cap, CER 50V 20% .22µF 1210
C15, 16, 17, 19 20	Cap, poly shld 0.22µF 1% 30V min
C18, 23, 25, 35 38, 39, 40, 43, 102-104, 109-114 118-130, 134, 136-139146, 150, 153	Cap CER 50V 10% .047µF X7R 0805
C21, 30, 100, 115-117, 145	Cap, CER 50V 10% 0.100µF X7R 1206
C22, 108, 159, 160	Cap, CER 5% 50V .047µF 0805
C24, 26	Cap, poly shld 1.0 µF 1% 30V min
C31-34, 44, 45, 135, 154, 155	Cap, Tant 10V 10% 47µF 7343
C36, 42, 151, 156, 157	Cap, Tant 20V 10% 1µF 3216
C41	Cap, Super 5.5V .047µF
C46	Cap, poly 30V 1% .22µF
C48, 49, 161, 162	Cap, CER 50V 10% 2200PF X7R 0805
C107	Cap, CER 50V 10% 3300PF X7R 0805
C147	Cap, CER 50V 10% .022µF X7R 0805
Resistors	
R1, 4, 46, 103	Res, TF 1/10W 1% 1.0M 0805
R2, 11	Res, TF 1/10W 1% 75Ω
R3, 42-44, 101 124-126, 131, 135, 140-142 149, 151, 154 155, 161, 162	Res, 1/10W 1% 1.00K 0805

Designator	Description
Resistors, continued	
R5, 26,109,117	Res, TF 1/10W 1% 21.5K 0805
R6, 29, 105, 106, 110, 112, 130	Res, 1/10W 1% 49.9Ω 0805
R7, 10,16,136 144, 145, 148, 150, 152, 153, 160	Res, TF 1/10W 1% 100K 0805
R8, 36	Res, TF 1/10W 1% 30.9K 0805
R9	Res, TF 1/10W 1% 15.0K 0808
R12, 13, 27, 35, 39, 100, 107 115, 123, 137	Res, TF 1/10W 1% 10.0K 0805
R14	Res, 1/8W 0.1% 76.8K 1206
R15	Res, 1/8W 0.1% 51.1K 1206
R17, 114	Res, TF 1/10W 1% 402K 0805
R18, 23	Res, TF 1/10W 1% 6.19K 0805
R19	Res, TF 1/10W 1% 200K 0805
R20	Res, 1/10W 1% 49.9K 0805
R21	Res, TF 1/10W 1% 12.4K 0805
R22	Res, TF 1/10W 1% 24.9K 0805
R24	Res, 1/10W 1% 750K 0805
R25, 139	Res, TF, 1/10W 1% 221Ω 0805
R28, 122	Res, TF 1/10W 1% 340K 0805
R30, 163	Res, TF 1/10W 1% 124K 0805
R31	Res, TF 1/10W 1% 487K 0805
R32	Res, TF 1/10W 1% 976K 0805
R33	Res, TF 1/10W 1% 243K 0805
R34	Res, TF 1/10W 1% 1.91K 0805
R37	Res, TF 1/10W 1% 15.4K 0805
R38	Res, TF 1/10W 1% 61.9K 0805
R45	Res, TF 1/10W 1% 332Ω 0805
R102	Res, TF 1/10W 1% 6.34K 0805
R104	Res, TF 1/10W 1% 20.0K 0805
R108	Res, TF 1/10W 1% 14.7K 0805
R111	Res, TF 1/10W 1% 7.5K 0805
R113	Res, TF 1/10W 1% 332K 0805
R116	Res, TF 1/10W 1% 33.2K 0805
R118, 119	Res, TF 1/8 W 0.1% 1K 1206
R120	Res, TF 1/10W 1% 20.05Ω 0805
R121	Res, WW, 1/2W 1% 0.50HM SMD
R127, 129	Res, 1/8W 0.1% 10K 1206
R128	Res. 1/10W 1% 511Ω 0805
R132	Res, 1/10W 1% 31.6K 0805

4.2 Analog board components (continued)

Designator	Description
Resistors, continued	
R133, 134	Res, TF 1/10W 1% 51.1K 0805
R138	Res, TF 1/10W 1% 357K 0805
R143	Res, 1/10W 1% 681Ω 0805
R146	Res, TF 1/10W 1% 316K 0805
R147, 157	Res, TF 1/10W 1% 13.7K 0805
R156	Res, TF 1/10W 1% 750Ω 0805
R158	Res, TF 1/10W 1% 301K 0805
R164, 165	Res, TF 1/10W 1% 3.92K 0805
Diodes	
D1	Shunt, vlt reg, LM4040 SOT-23
D2, 100, 101 102	Diode, dual Schottky SOT-2
D3	Diode, dual BAV70 SOT-23
D4 - 7	Rect, SMB MBRS140T3 Schtky
D103	Diode, dual silicn BAV99 SOT-23
Transistors	
Q1,2	Xstr, PZT2222AT1 NPN SOT-223
Q3	Xstr, MOS pwr FET SMT
Q4, 6, 100	Xstr, VP0610 PFET SOT-23
Q5, 101	Xstr, N-CH DMOS FET 2N7002

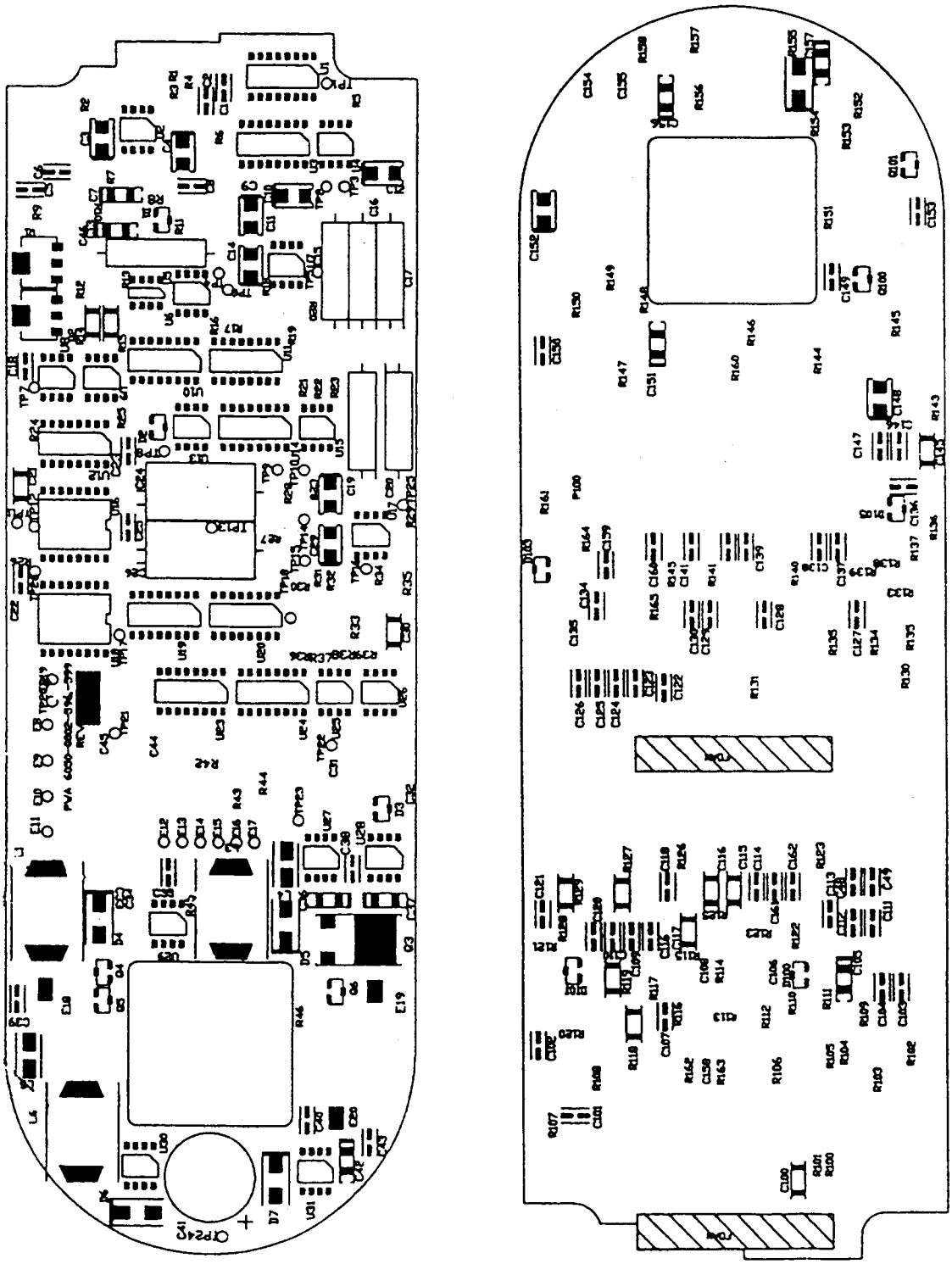
Designator	Description
Misc.	
L1, 6	Indctr, 100µH ± 20% SMD
L3	Indctr, 220µH ± 20% SMD
L4, 5	Indctr, 1.8µH ± 10% SMD
P1	Conn, fem 80 pin SMT
Integrated circuits	
U1, 19	74HC4053 triple 2 ch MUX
U2	TL072C LW NSE 2 JFET opamp
U3, 10, 12, 14	74HC4316 quad bi-lat swch
U4, 6, 9,13,15	IC, opamp, dual OP297 SO-8
U5	IC, TC4W53 SPDT SW SMD-8
U7	IC, OPA OP97 LW PWR SO-8
U8	IC, sgl sply opamp OP291 SO-8
U11, 20,23,24	74HC4051 8-to-1 MUX SO-16
U16, 18	LTC10763 filter 5th order LP
U17	IC, opamp JFET OP15 SO-8
U25	IC, LM6482 R-R opamp SO-8
U26	IC, dual lo pwr comp LT1017
U27	IC, LT1432 SO-8
U28	LT1172CS8 1.25A 100KHz SW reg
U29, 30	IC, DC-DC convrtr 5V-12V LT1110
U31	IC, LT1121 SO-8

Additional components

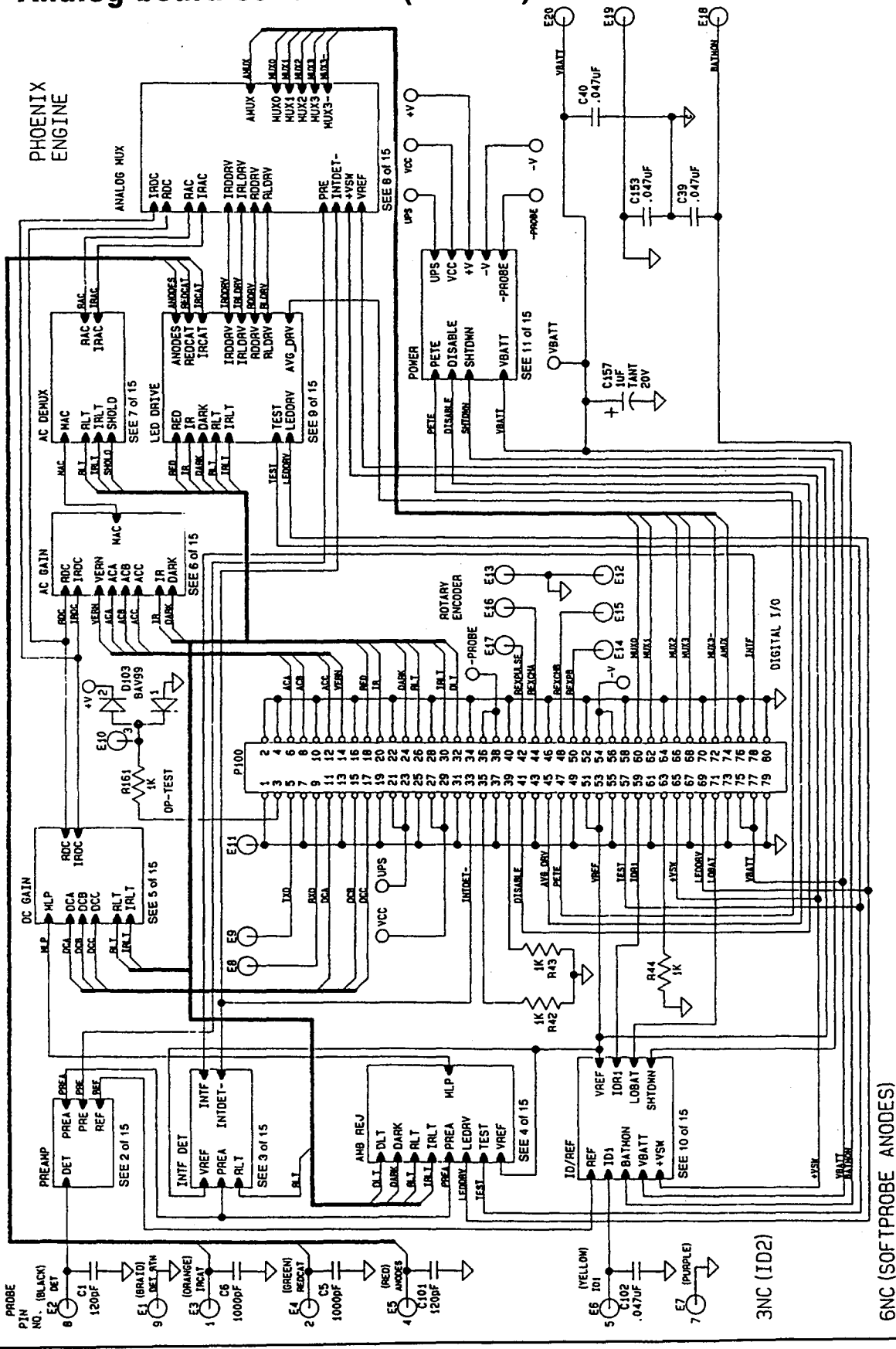
Item	Description	Model
1	Switch, rotary encoder	3775
2	Contact, power	3770/3775
3	Assy, receptacle overmold	3770/3775
	Tubing, heatshrink 3/16 in. (0.5833 ft.)	3770/3775
	Tubing, shrink clear 1/16 in. (0.268 in.)	3770/3775

4.3 Analog board layout

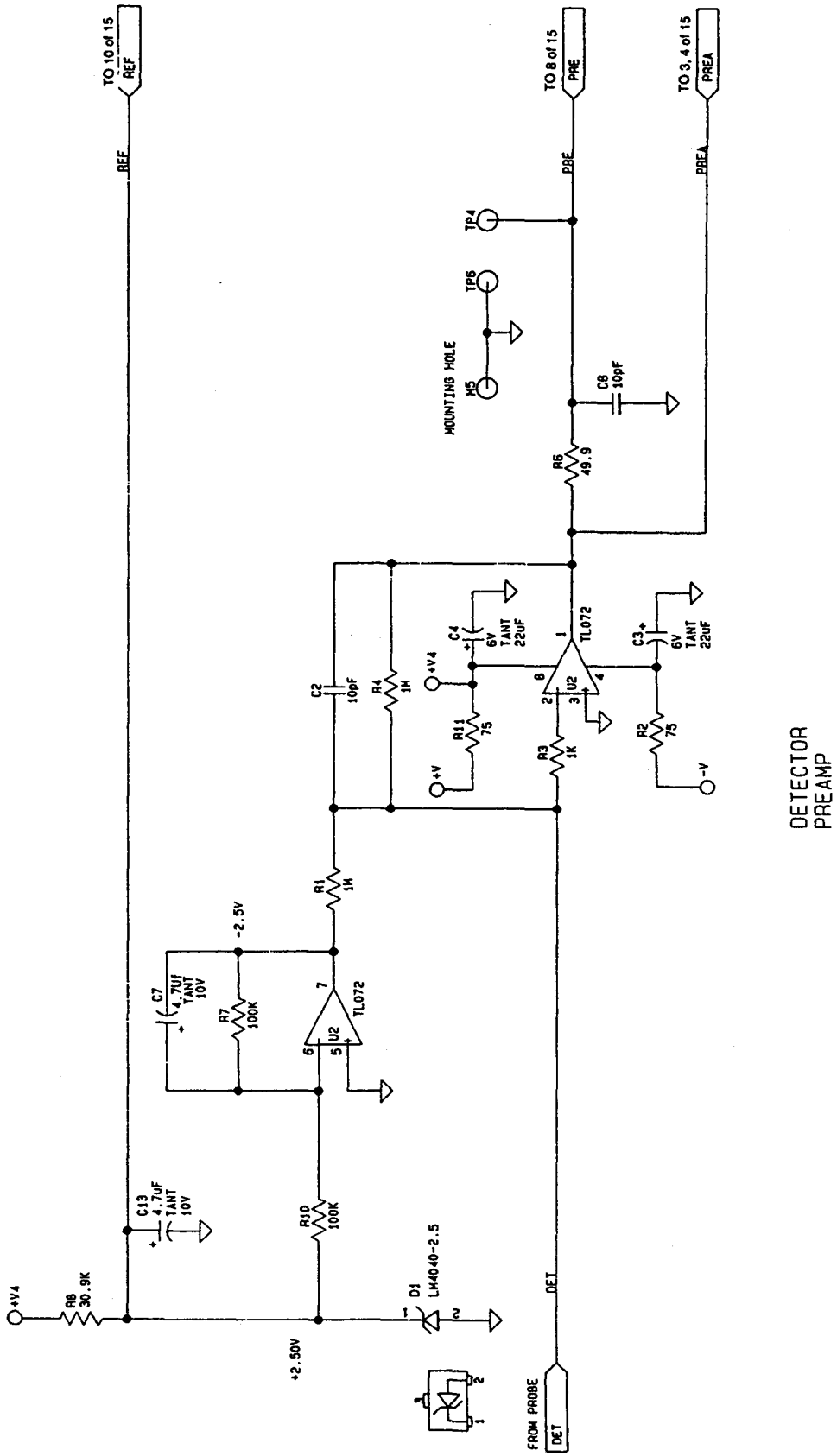
Note: The difference between the analog boards for the 3770 and the 3775 oximeters is the installation of the rotary encoder on the 3775 analog board (depicted here); in all other respects the boards and their components are identical.



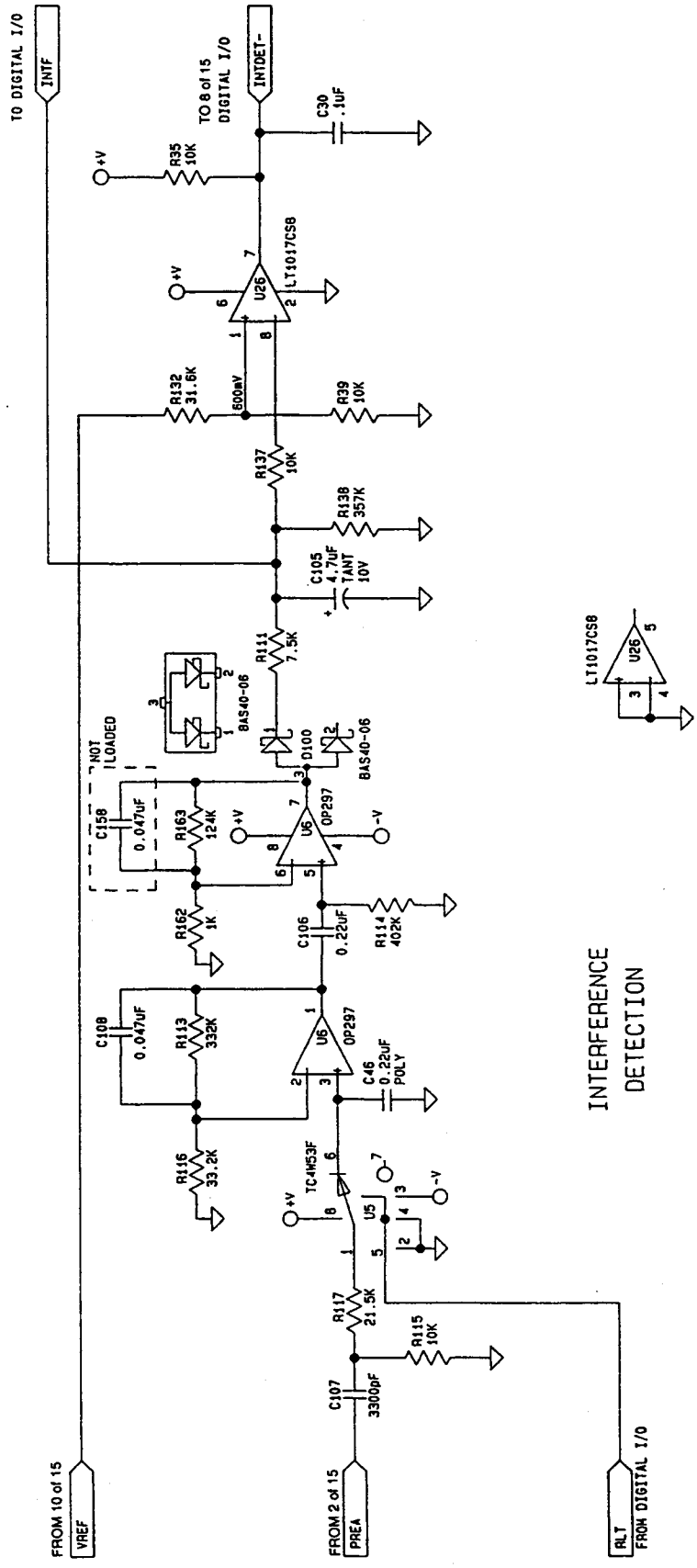
4.4 Analog board schematic (1 of 15)



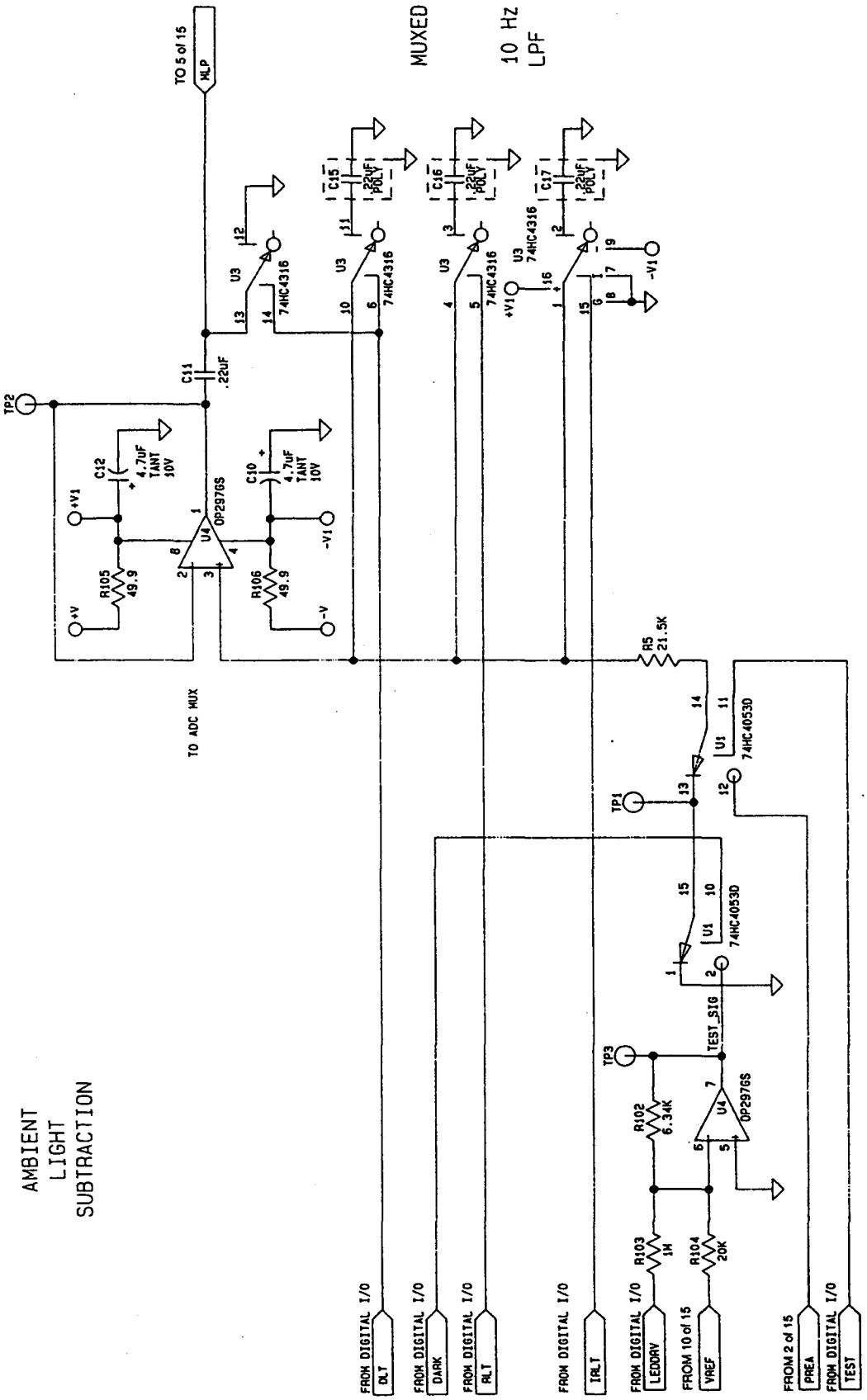
4.4 Analog board schematic (2 of 15)



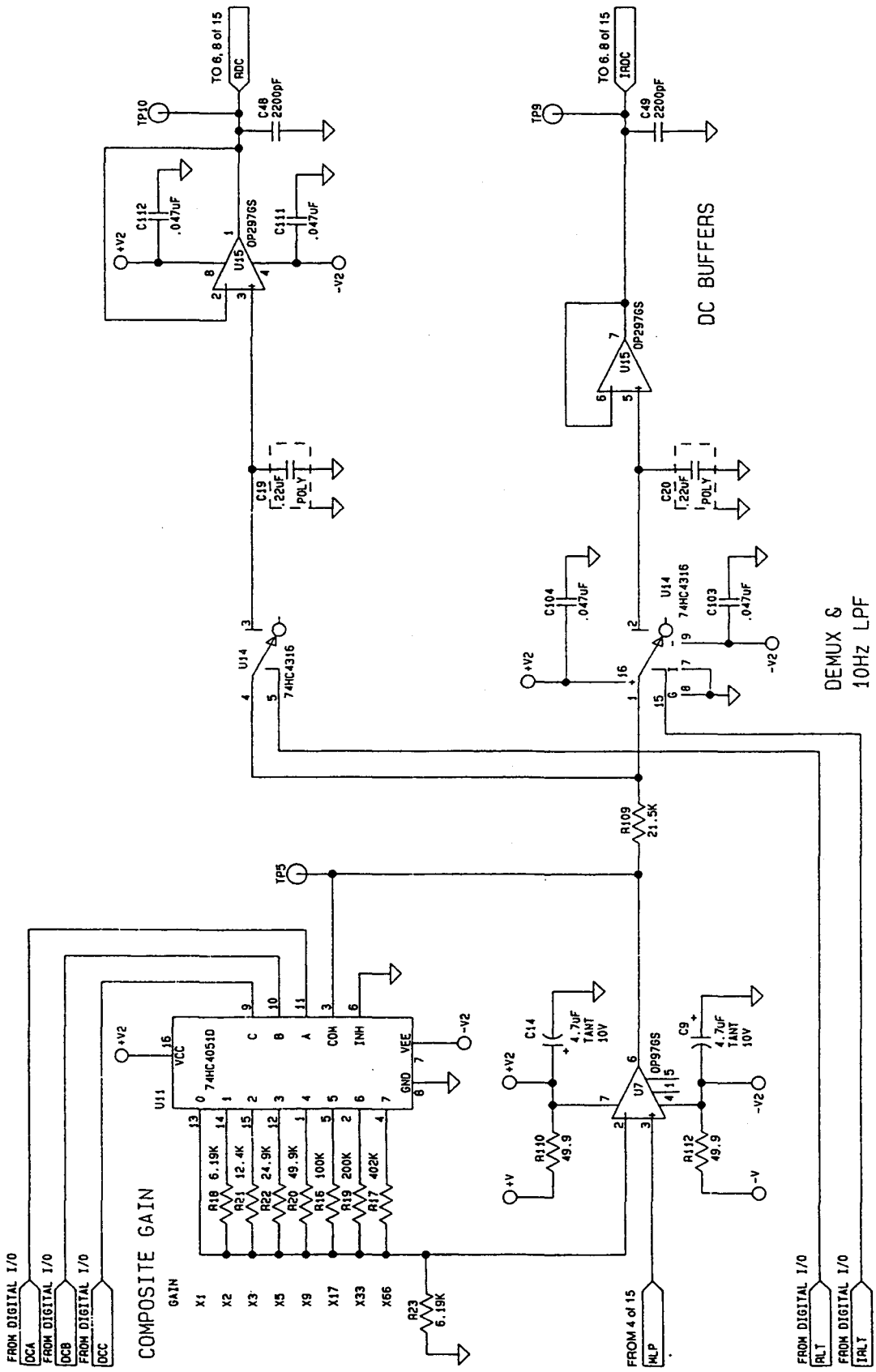
4.4 Analog board schematic (3 of 15)



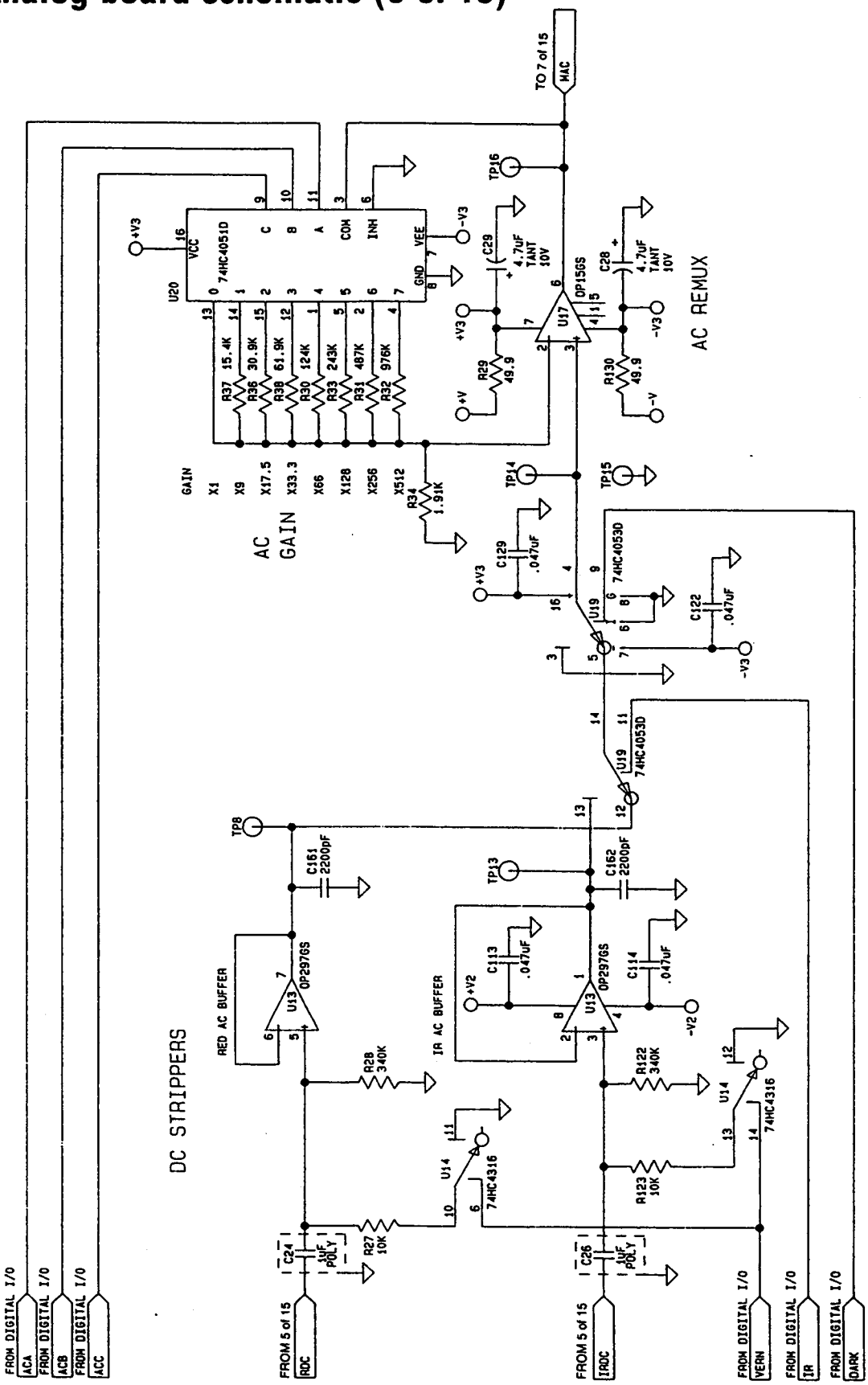
4.4 Analog board schematic (4 of 15)



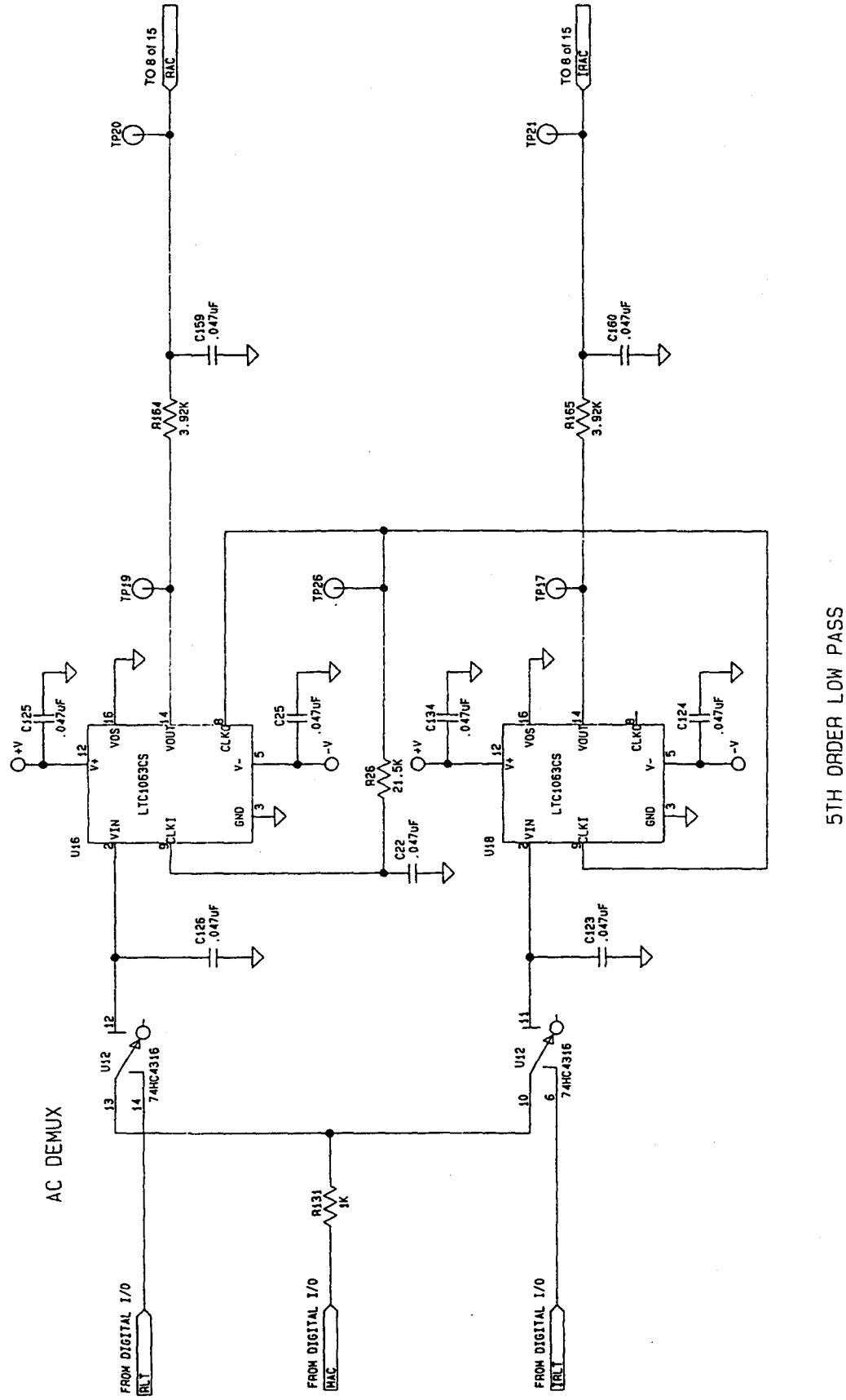
4.4 Analog board schematic (5 of 15)



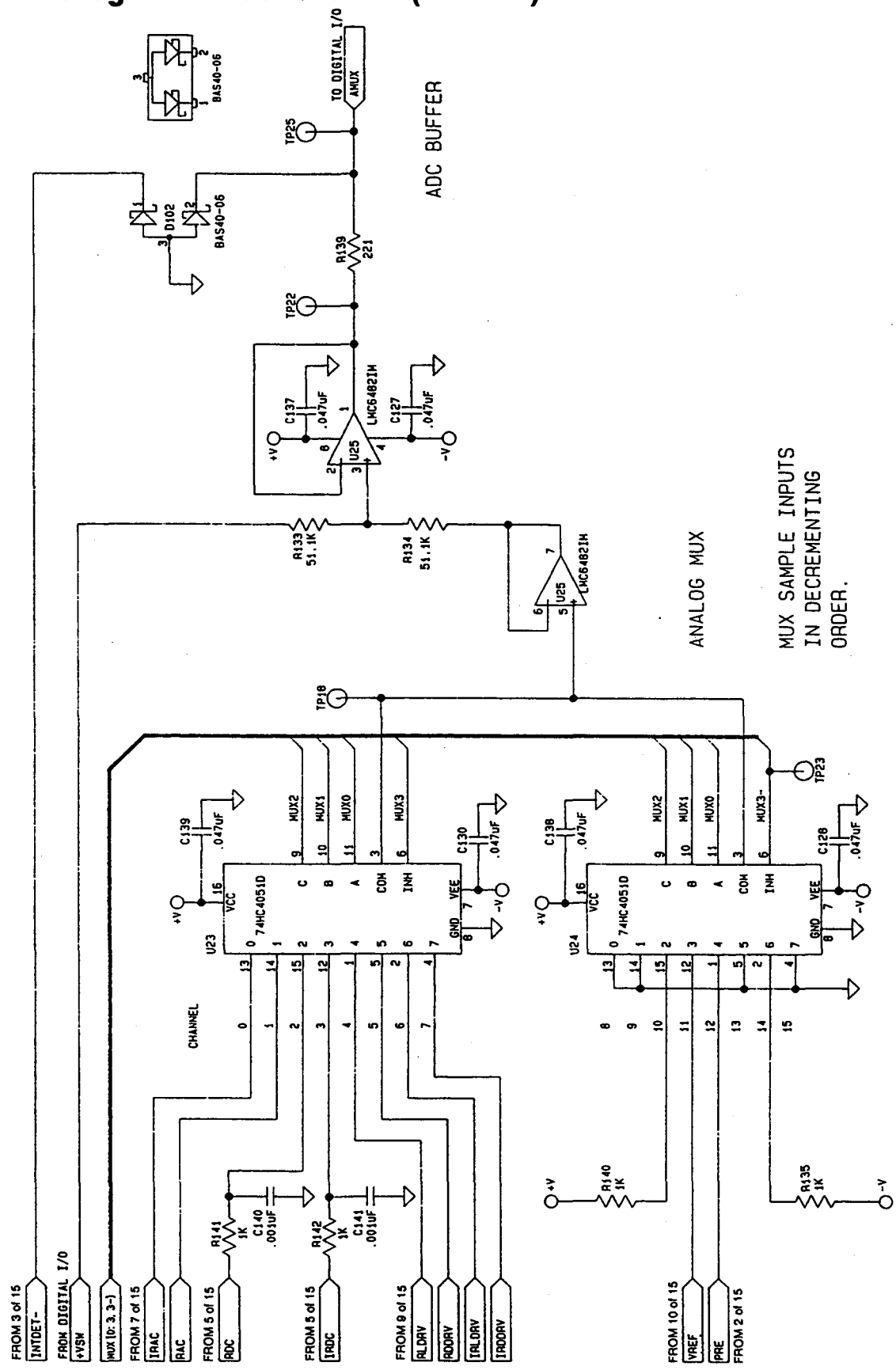
4.4 Analog board schematic (6 of 15)



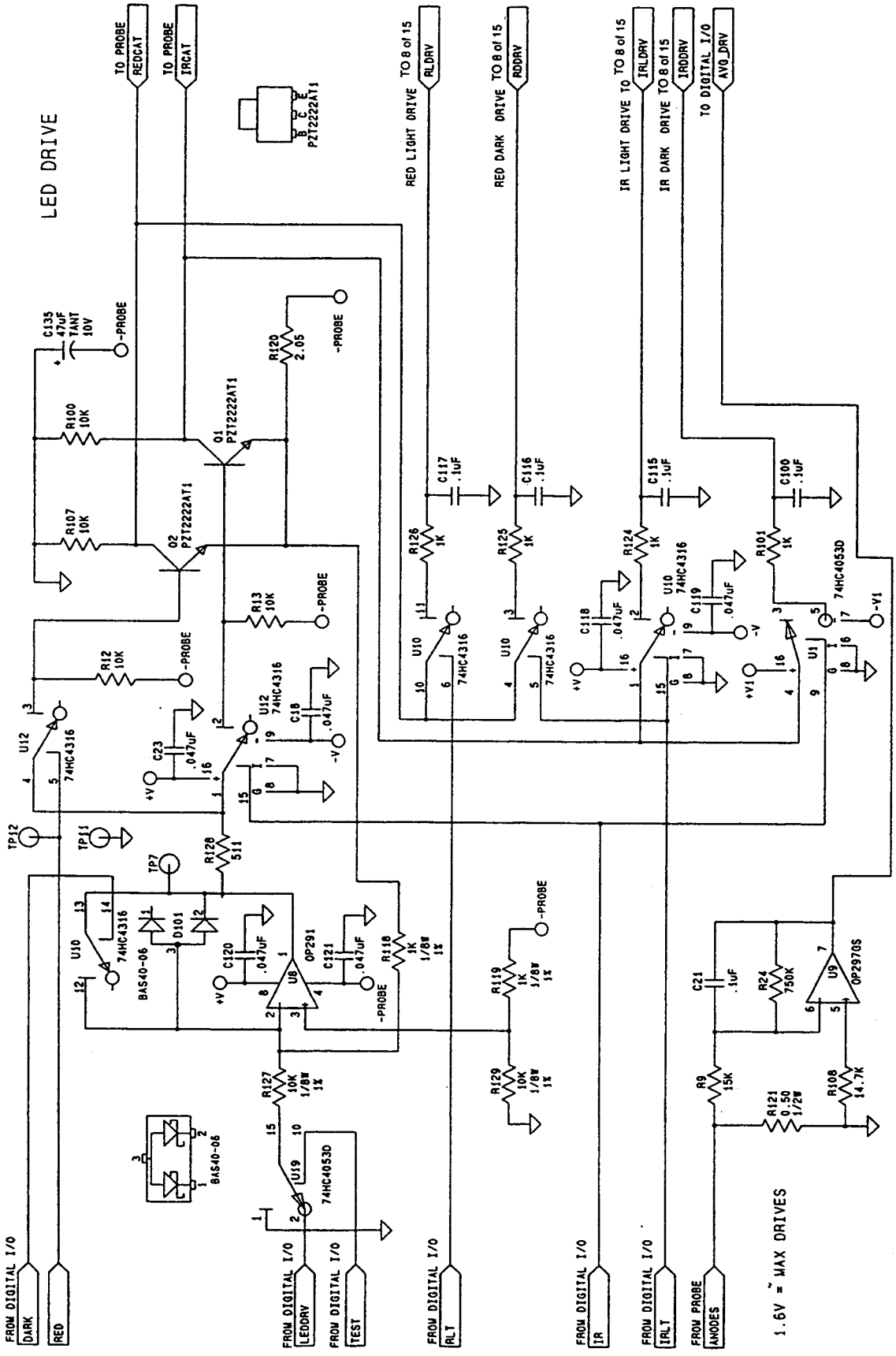
4.4 Analog board schematic (7 of 15)



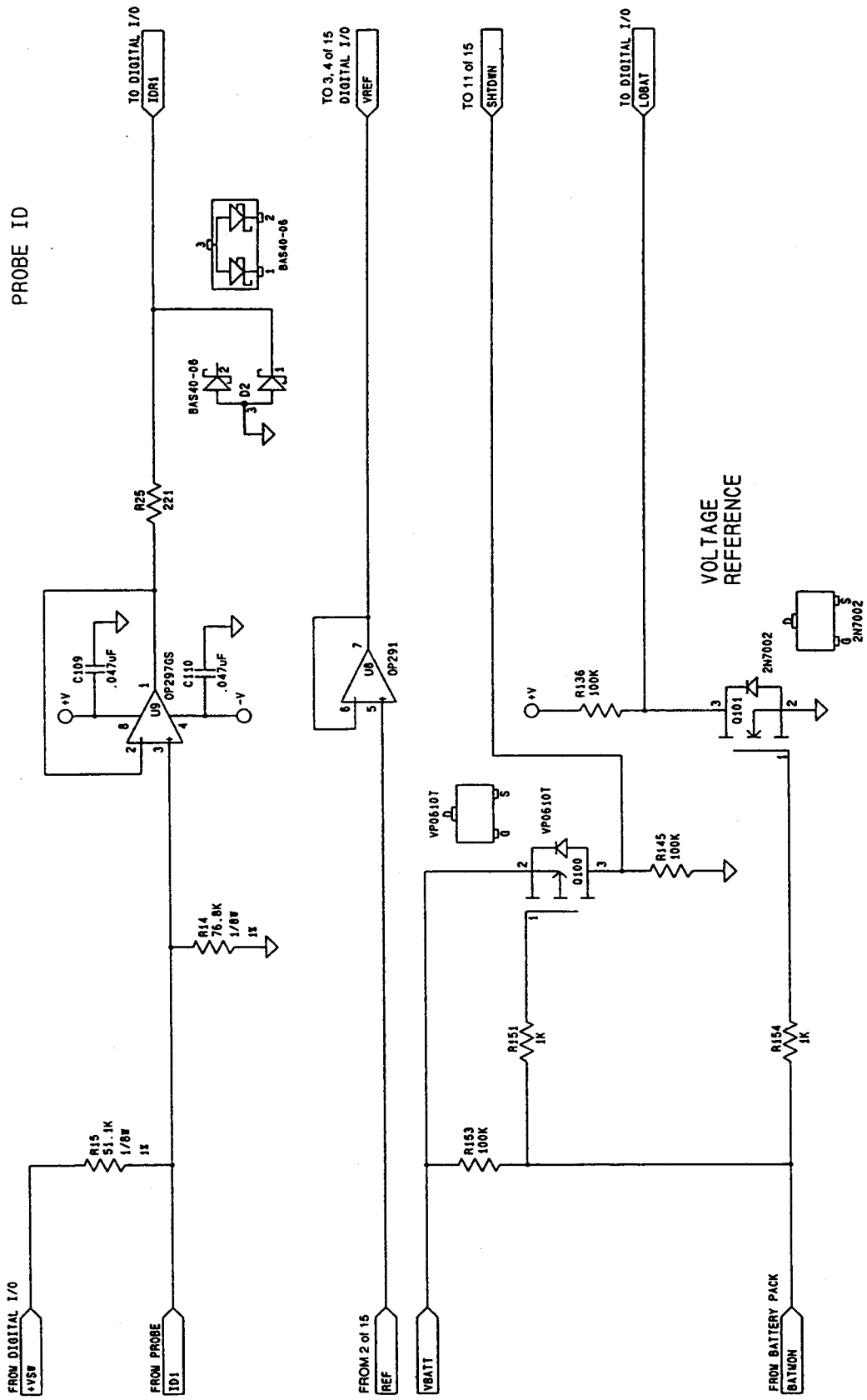
4.4 Analog board schematic (8 of 15)



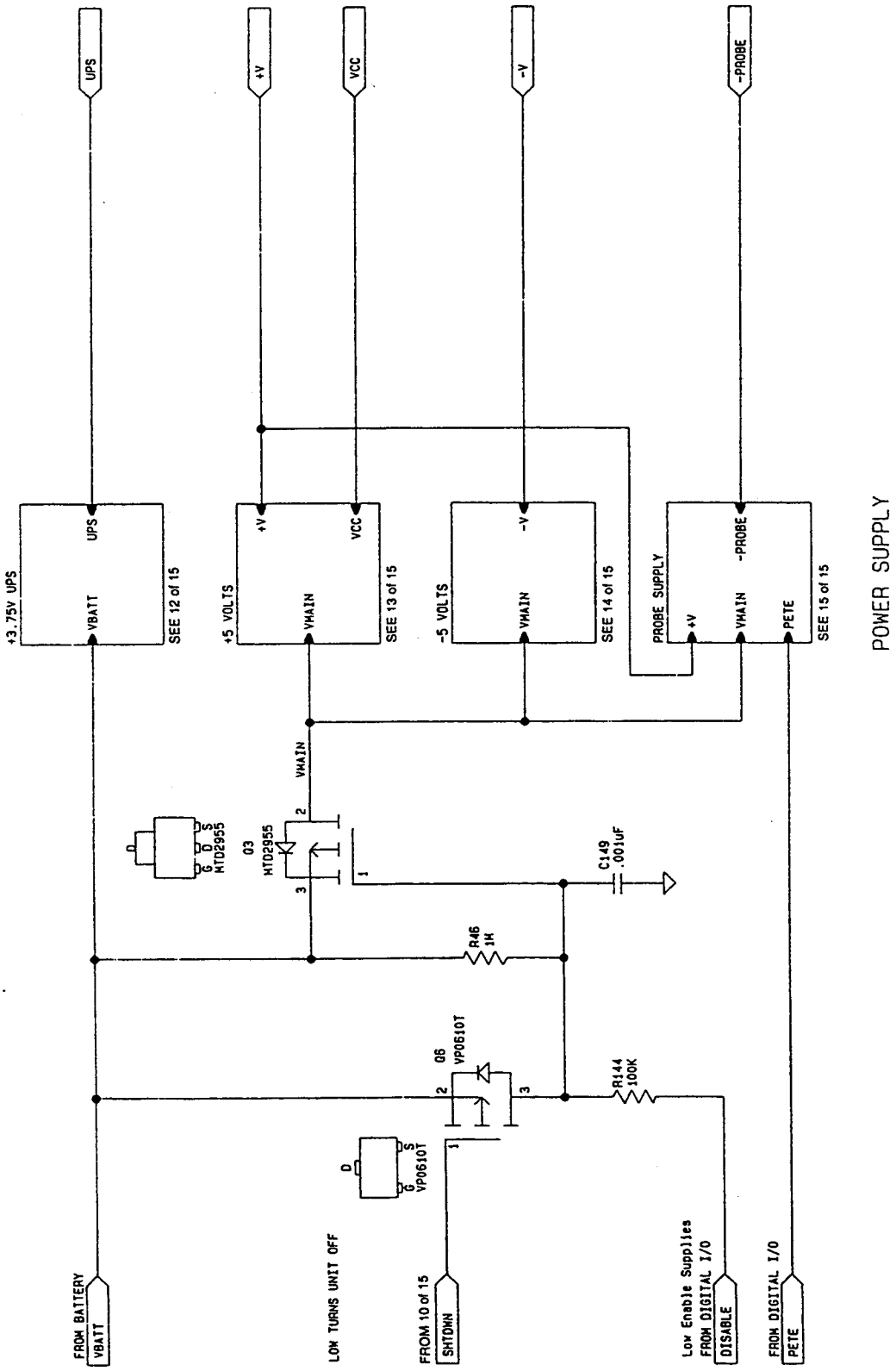
4.4 Analog board schematic (9 of 15)



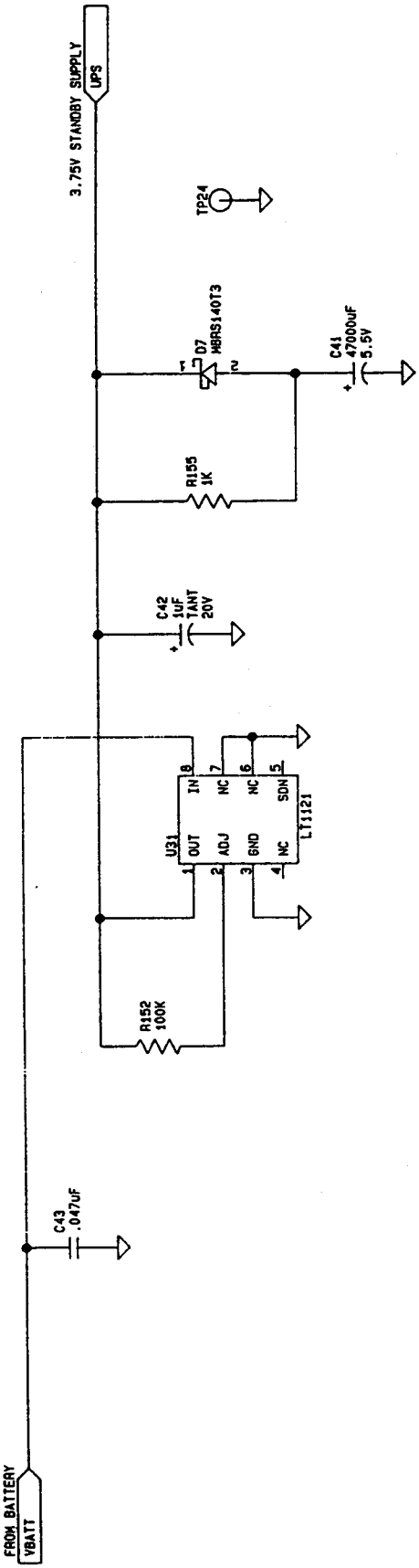
4.4 Analog board schematic (10 of 15)



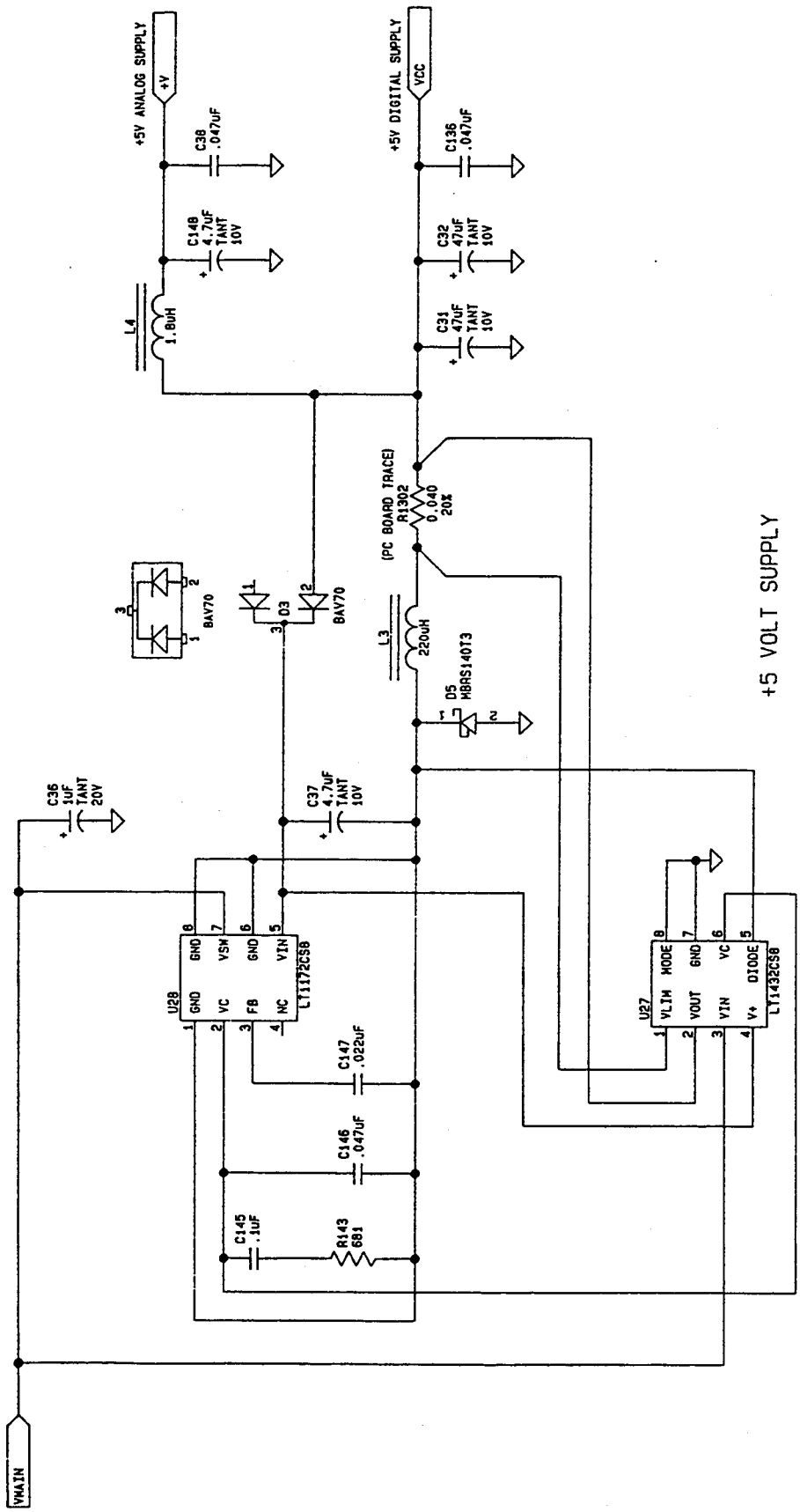
4.4 Analog board schematic (11 of 15)



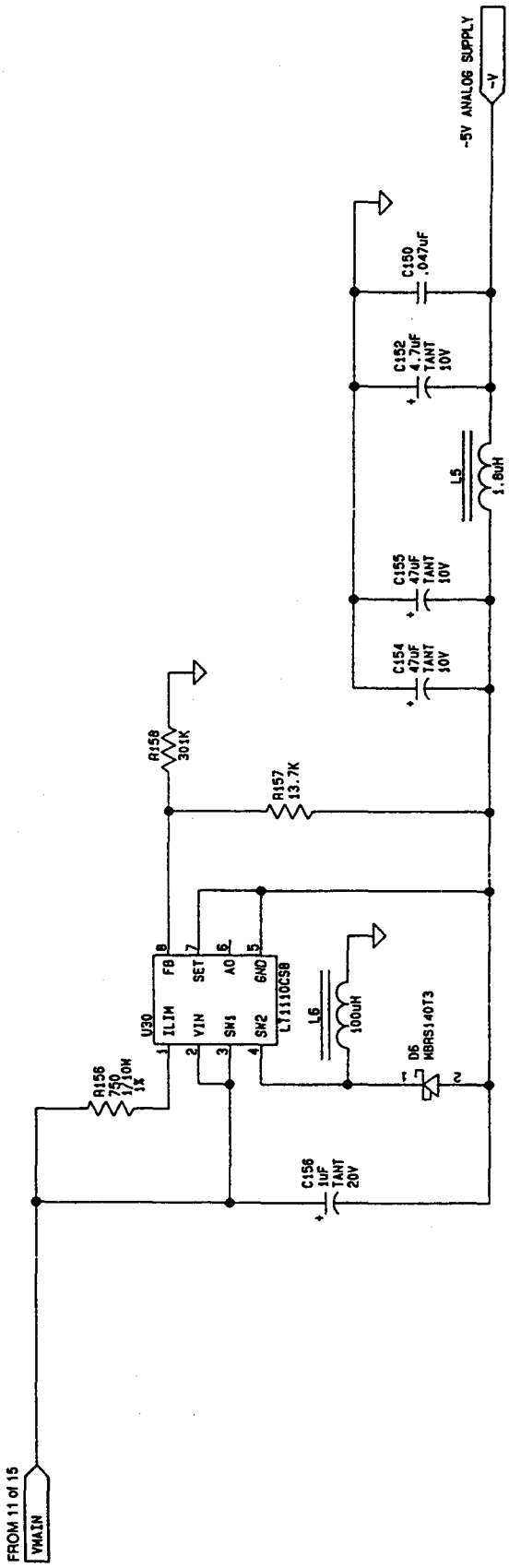
4.4 Analog board schematic (12 of 15)



4.4 Analog board schematic (13 of 15)

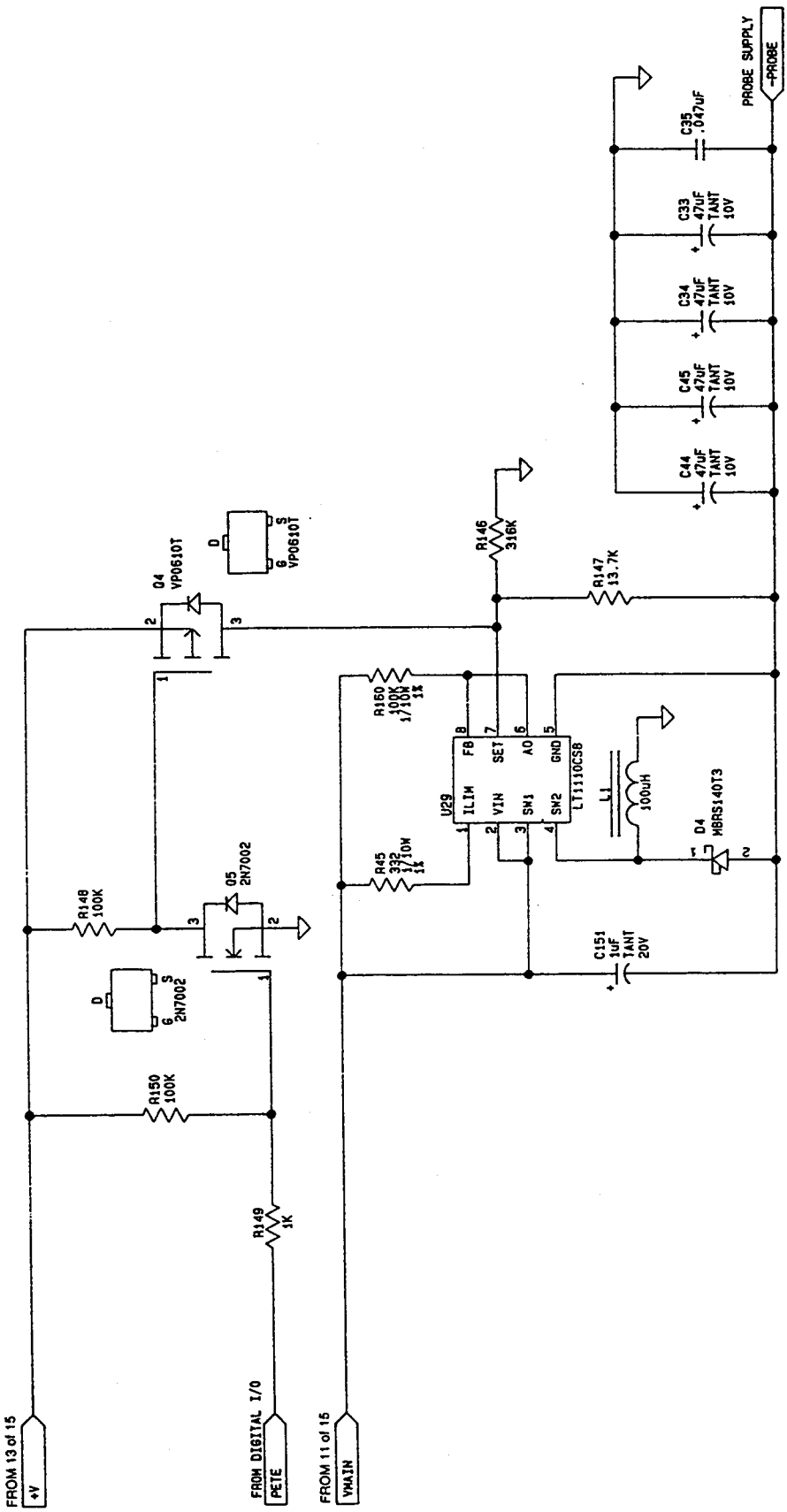


4.4 Analog board schematic (14 of 15)



-5 VOLT SUPPLY

4.4 Analog board schematic (15 of 15)



PROBE SUPPLY

5/Digital Board

This chapter contains:

- A general description of the digital board .
- A block diagram of the digital system.
- A list of digital board components.
- The digital board layout.
- The digital board schematics.

5.1 General description

Refer to Figure 4-1 in 4/Analog Board and to Figure 5-1 in this section.

The core processing of the digital board is provided by a 16-bit processor, nonvolatile FLASH memory, semivolatile SRAM, and a Real Time Clock. For signal acquisition, it has an A-to-D converter (which is internal to the processor), I/O ports for timing and control, and an 8-bit D-to-A converter.

The 80-pin board-to-board connector contains signals shared by the analog and digital boards: power supplies, rotary encoder signals, oximetry timing and control, and many ground connections.

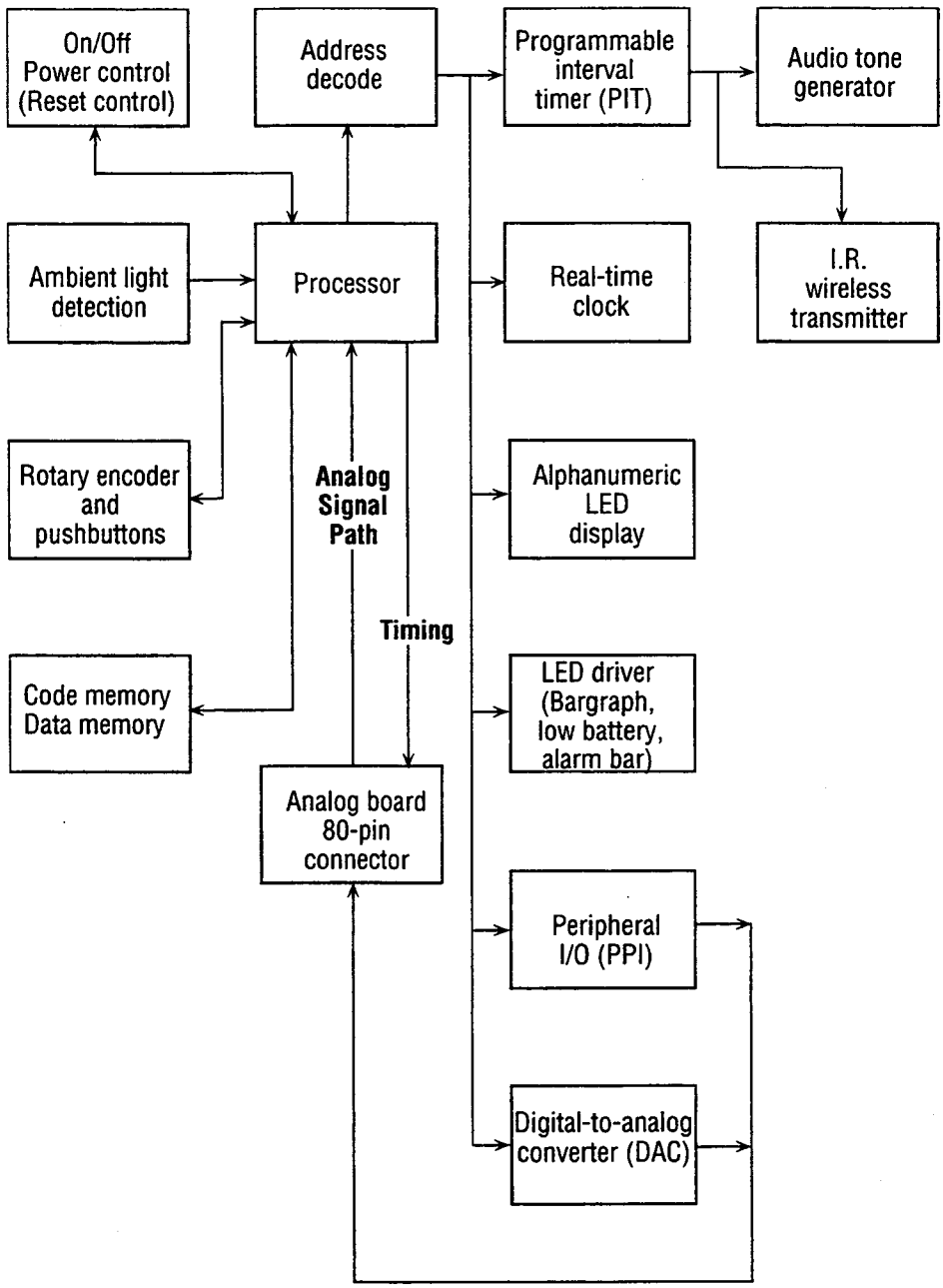


Figure 5-1. Digital system block diagram

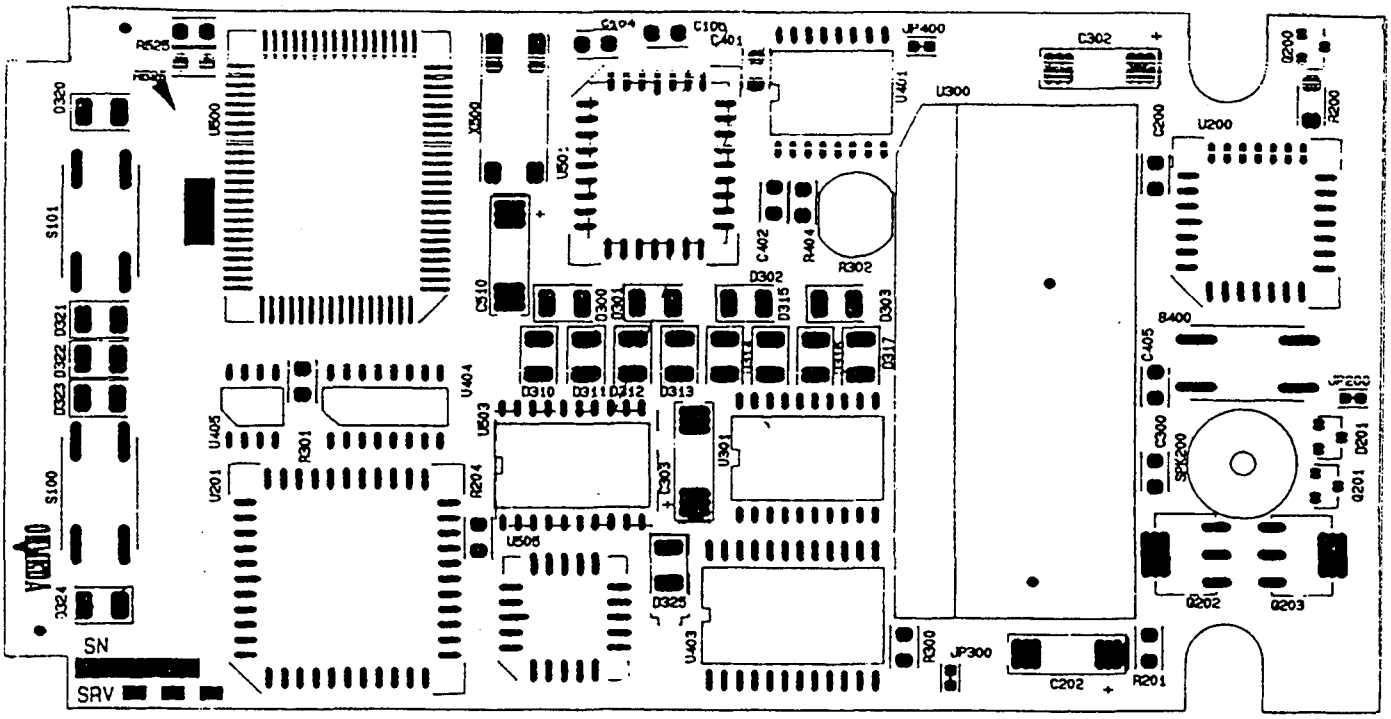
5.2 Digital board components 6050-0002-636 (3700) & 6050-0002-598 (3775)

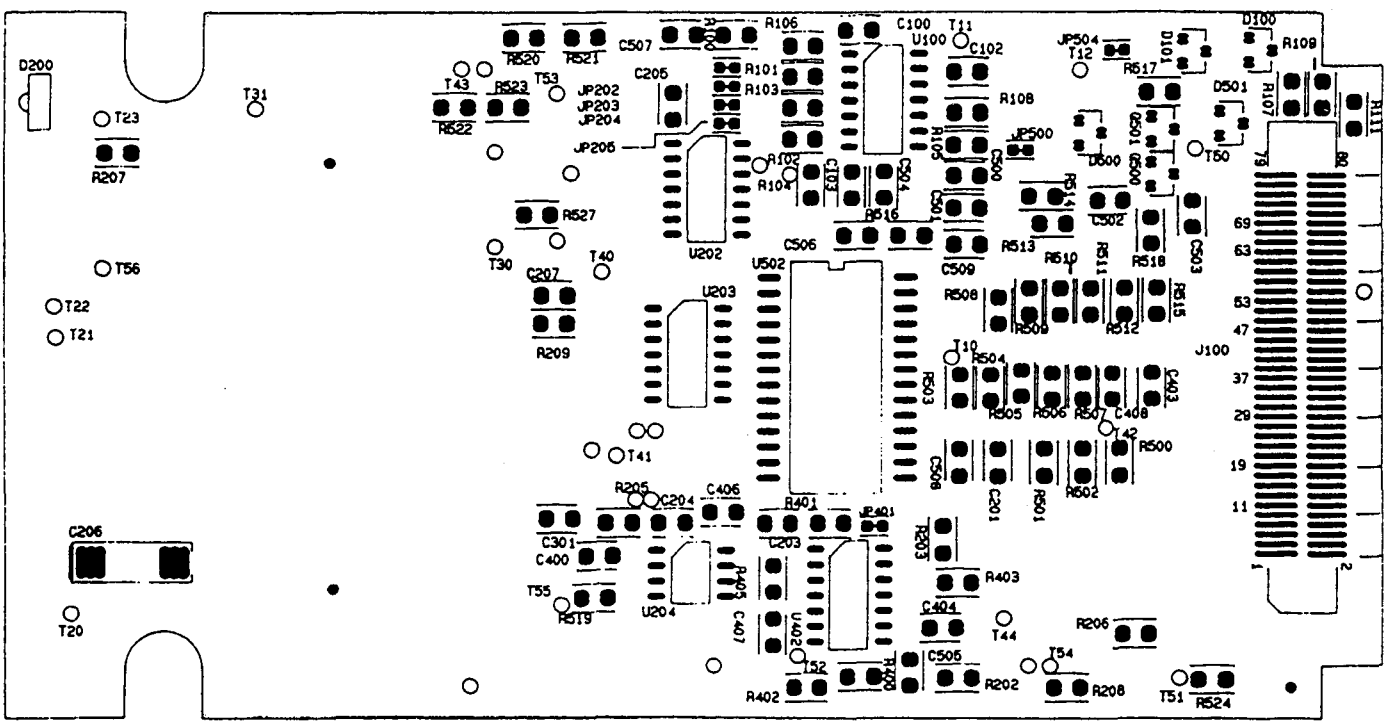
Note: Designators shown in the list below in brackets [204] **apply only to the 3775**; all others apply to both boards except where noted.

Designator	Description
Capacitors	
C[100,102],103 200,201, [203–205,207],300,301,[400], 401-403,405,406,502-509	Cap, Mono 50V 5% .033µF X7R 0805
[C202]	[Cap, Tant 10V 10% 33µF SMD 7343]
[C206]	[Cap, Tant 2.2µF 50V 10% 7343]
C302,303,510	Cap, Tant 10V 10% 47µF 7343
C404,407	Cap, Mono 50V 5% 100PF 0805
C408	Cap, Mono 50V 5% 220PF NPO 0805
C500,501	Cap, Mono 50V 5% 33PF NPO 0805
Resistors	
R100,105	Res, TF 1/10W 1% 221K 0805
R101,102,107 109,111,202, 203,[204],206-208, [209],402-405,518,520, *521-3770 only*,522,523	Res, TF 1/10W 1% 10.0K 0805
R103,104	Res, TF 1/10W 1% 4.75K 0805
R106,108	Res, TF 1/10W 1% 20.0K 0805
[R200]	[Res, TF 1/8W 1% 221Ω 1206]
[R201]	[Res, TF 1/10W 1% 499Ω 0805]
[R205]	[Res, TF 1/10W 1% 5.36K 0805]
R300,301,401, 517	Res, TF 1/10W 1% 2.21K 0805
R302	Res, Light dependent
R400,524-527	Res, TF 1/10W 1% 100K 0805
R500-516	Res, TF 1/10W 1% 10.0Ω 0805
R519	Res, 1/10W 1% 100Ω 0805
Diodes	
D100,101,[201]	Diode, dual silicn BAV99 SOT-23
[D200]	[Diode. GaAs IRL80A IR emtr]
D500,501	Diode, BAS70-06 SOT-23 Schott
LEDs	
D300,325	LED chip SMT orange
D301	LED, chip Hi-eff SMT yellow
D302,310-317	LED, chip Hi-eff SMT green
D303	LED, chip SMT pure green
[D320,321,323, 324]	[LED, chip Hi-eff SMT red]

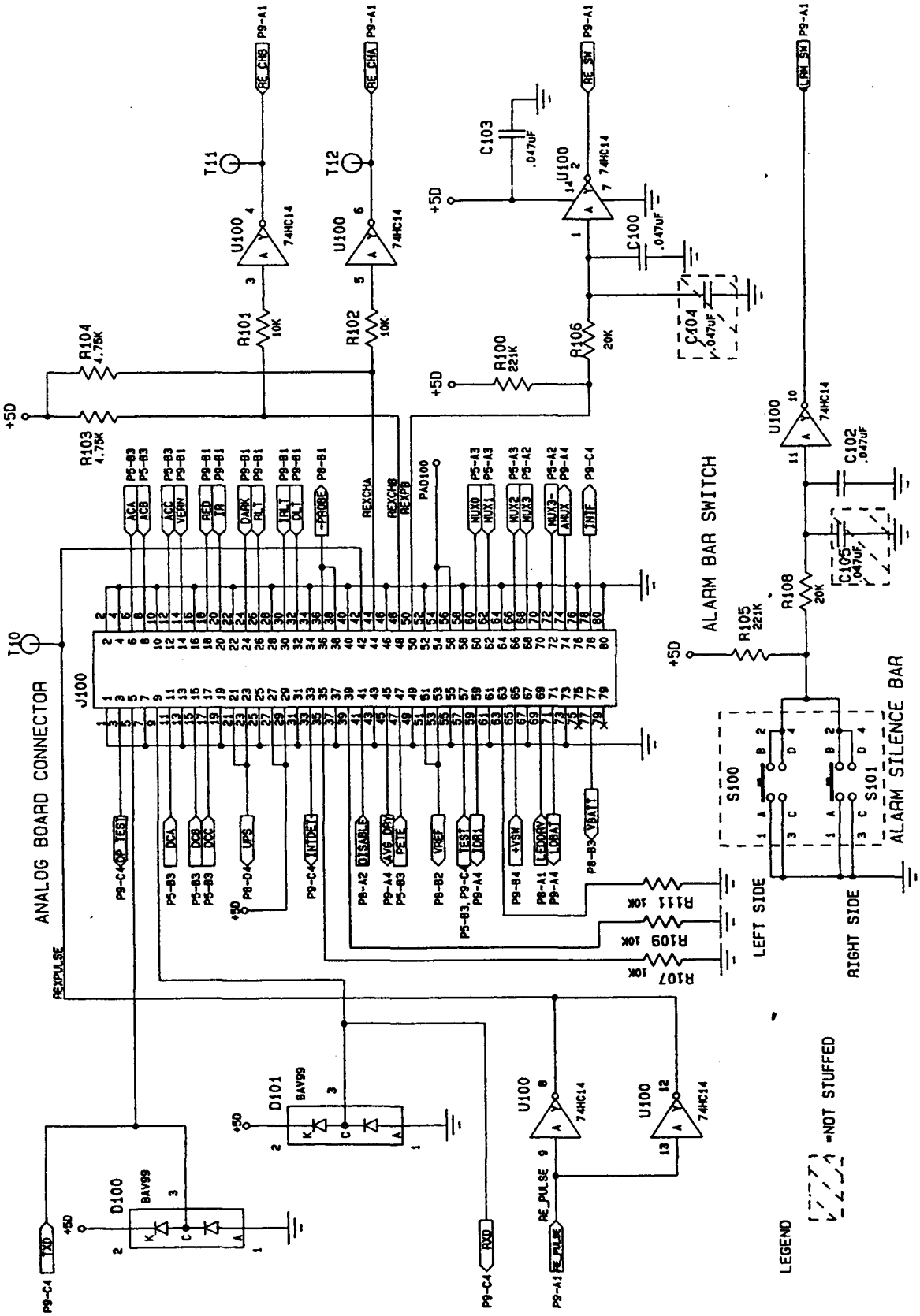
Designator	Description
Transistors	
[Q200,201[	[Xstr, N-ch DMOS FET 2N7002]
[Q202,203]	[Xstr, PZT2222AT1 NPN SOT-223]
Q500	Xstr, SIPMOS BSS84 P-CH MOS FET
Q501	Xstr, VN3306 SOT-23 N-CH DMOS FET
Integrated circuits	
U100	IC, CMOS HEX 74HC14 SMD Inv-Trig
[U200]	[IC, CMOS progmb intrvl timer]
U201	82C55A CMOS Prog perp Plc
[U202]	[74HC74 dual D-type F/F SM]
[U203]	[74HC02 Quad NOR gate SO-1]
[U204]	[IC, RC tmr SMD 7555]
U300	Disp, LED 8-char 5x7 0.2 in.
U301	IC, CMOS MC14489 LED display driver
U401	IC, CMOS Prcscr suprvsor
U402	IC, CMOS 3-gate pairs 4007
[U403]	[RTC72423 real-time clk w/crystal SOL-24]
U404	IC, CMOS MP7524SR 8-bit D-A converter
U405	TL072C LW NSE 2 JFET opamp
U500	IC, CMOS miprc 80-pin 8XC196K8
U501	Assy, CMOS 128K x 8 Flesh mem
U502	IC, CMOS 32768 x 8-bit CXK825AM
U503	IC, CMOS 74HC373 octal d-type latch
U505	Assy, PAL 16 V8
Misc.	
J100	Conn, male 8-pin SMT
S[100,101], 400	SW, LW-PRFL SPST gull-wing
[SPK200]	[Speaker, 5V 0.354" dia]
X500	Xstl, SMT 7.3728 MHz

5.3 Digital board layout

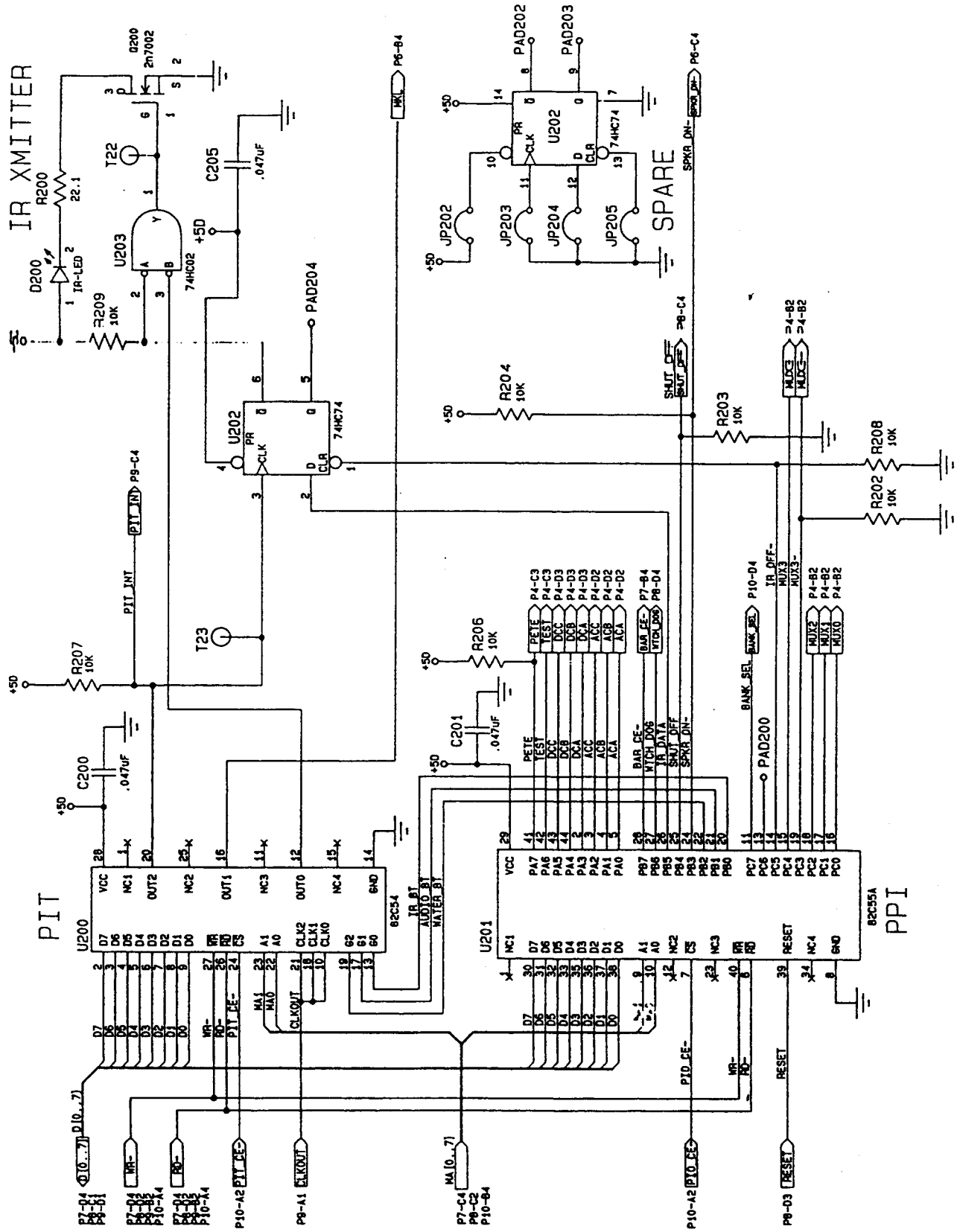




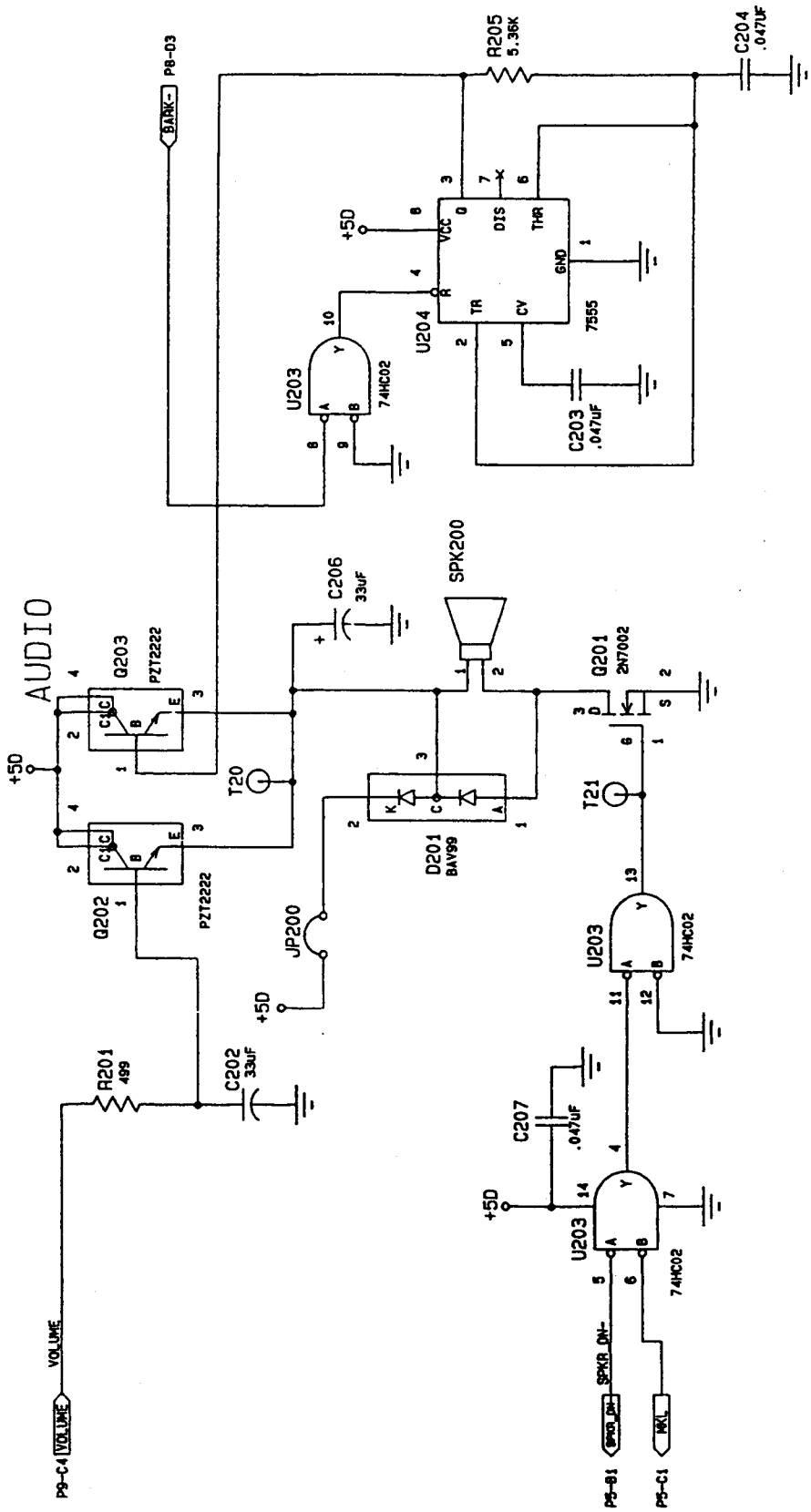
5.4 Digital board schematic (1 of 7)



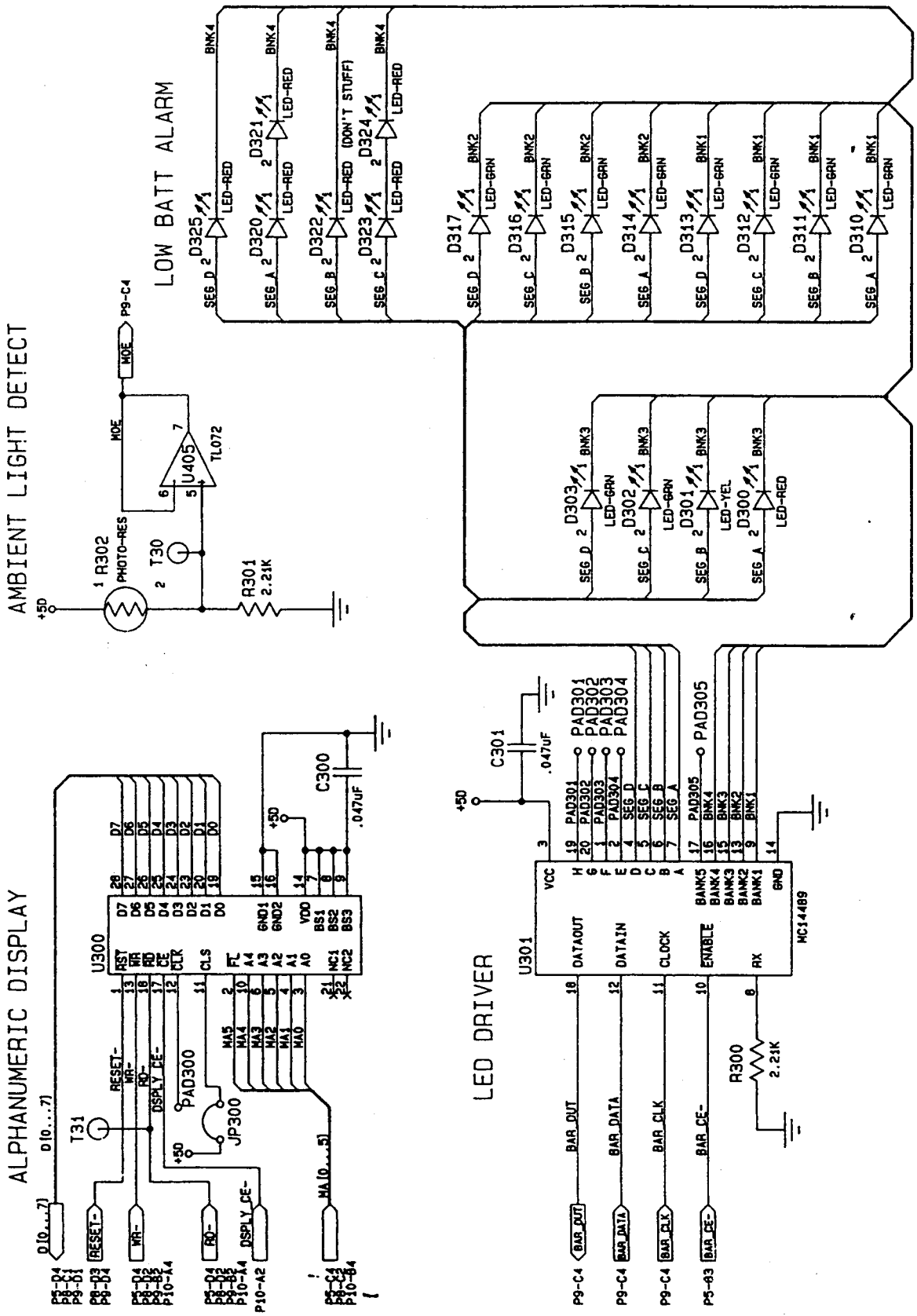
5.4 Digital board schematic (2 of 7)



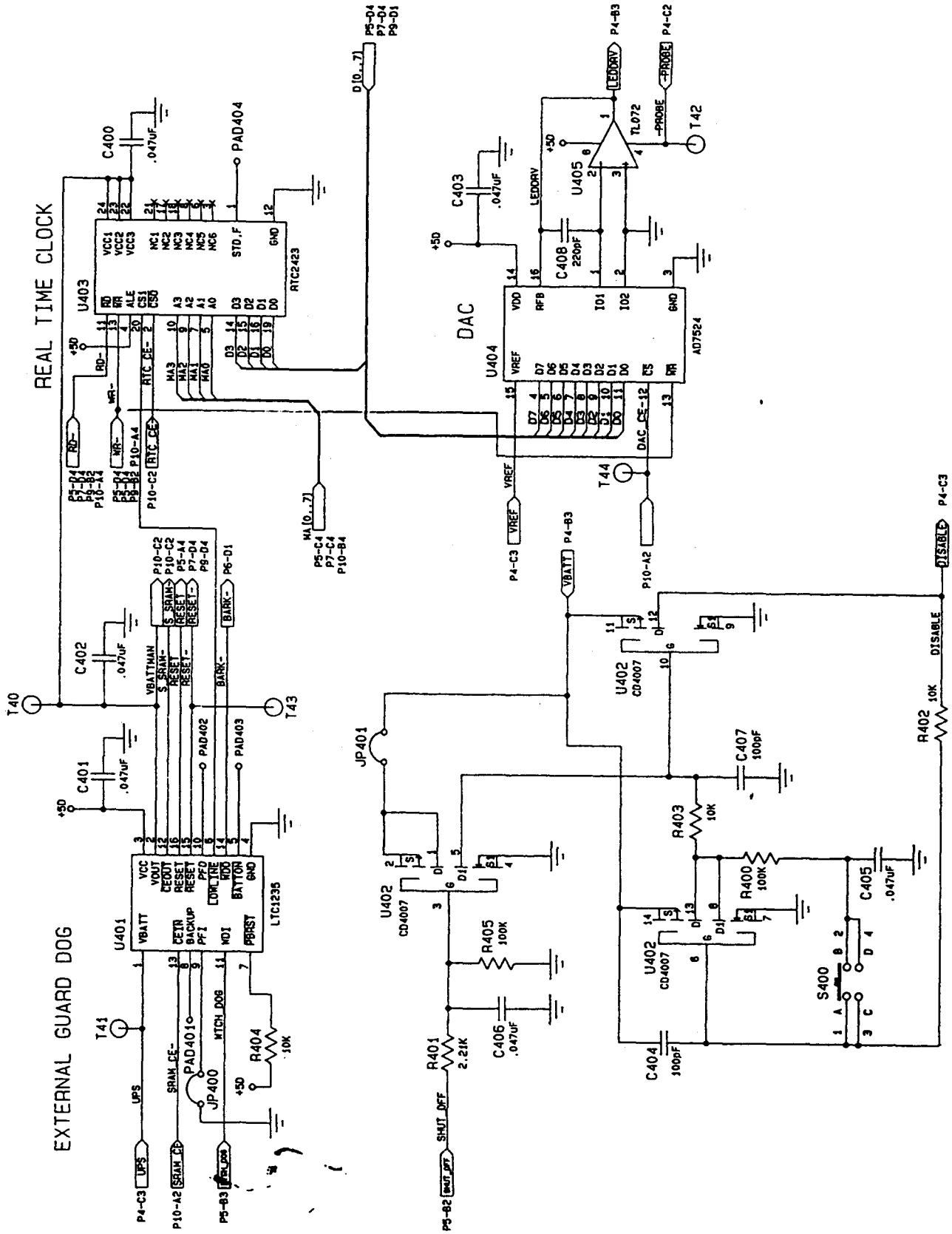
5.4 Digital board schematic (3 of 7)



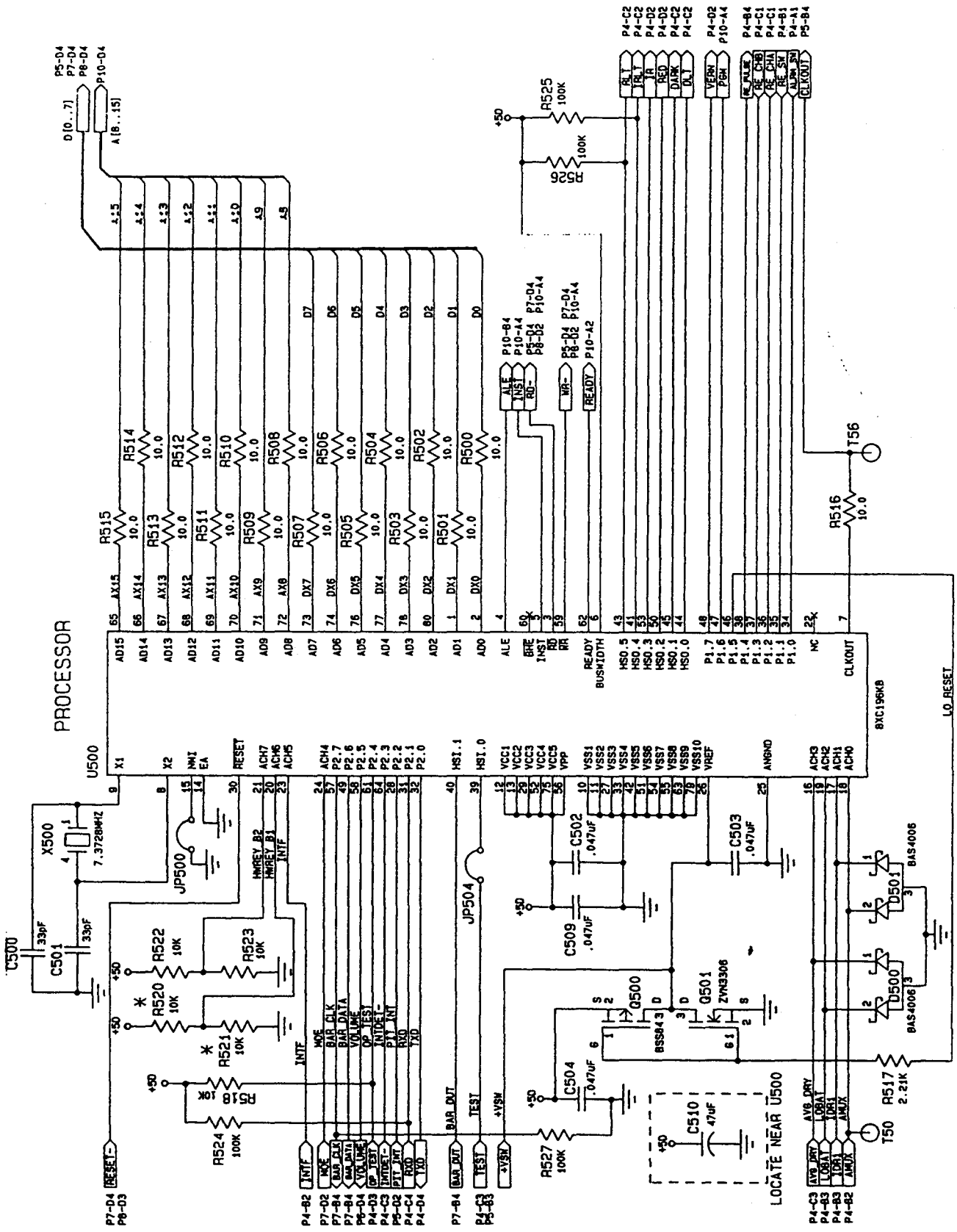
5.4 Digital board schematic (4 of 7)



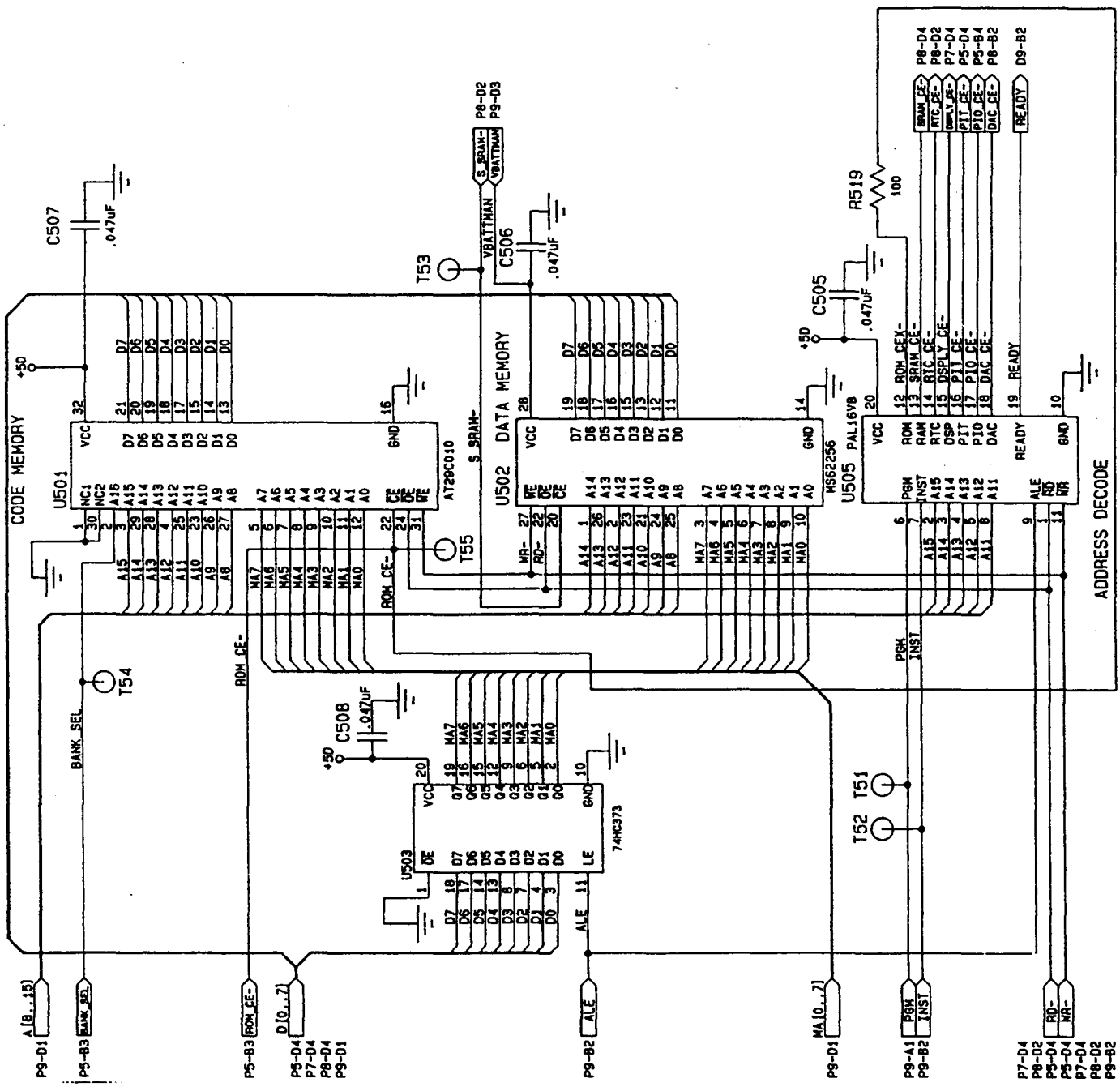
5.4 Digital board schematic (5 of 7)



5.4 Digital board schematic (6 of 7)



5.4 Digital board schematic (7 of 7)



Datex-Ohmeda

1315 West Century Drive
Louisville CO 80027-9560 USA
303 666 7001

Corporate Office

Datex-Ohmeda Division
Instrumentarium Corp.
PO Box 900
FIN-00031 Helsinki
Finland
Tel 358 9 39411
Fax 358 9 146 3310

Asia/Pacific

India

Datex-Ohmeda (India) Pvt. Ltd.
Oxygen House
P43 Taratala Road
Calcutta 700 088
India
Tel 91 33 478 4401
Fax 91 33 478 4342

Japan

Datex-Ohmeda K. K.
TRC Annex 9F
6-1-1 Heiwajima, Ohta-ku
Tokyo 143-0006
Japan
Tel 81 3 5763 6801
Fax 81 3 5763 6838

Datex-Ohmeda K. K.
Technical Center
TRC A Bldg. AE 4-8
6-1-1 Heiwajima, Ohta-ku
Tokyo 143-0006
Japan
Tel 81 3 5763 6801
Fax 81 3 5763 6838

Malaysia

Datex-Ohmeda
Malaysian Oxygen Berhad
13 Jalan 222
46100 Petaling Jaya
Selangor
Malaysia
Tel 60 3 755 4233
Fax 60 3 756 6389

Singapore

Datex-Ohmeda Pte. Ltd.
198 Yishun Avenue 7
Singapore 768926
Tel 65 753 6311
Fax 65 753 1817

Australia

Datex-Ohmeda Pty. Ltd.
Units 1 & 2
149 Arthur Street
PO Box 356
Homebush NSW 2140
Australia
Tel 61 132 229
Fax 61 297 461796

Europe

France

Datex-Ohmeda S. A. S
Parc de Pissaloup
8 Avenue Jean d'Alembert
78191 Trappes-Cedex
France
Tel 33 1 30 68 60 00
Fax 33 1 30 68 60 01

Datex-Ohmeda S. A. S
Siege Social Lyon
17 rue Jean-Elysee Dupuy
69410 Champagne Au Mont
D'Or
France
Tel 33 04 78 66 62 10
Fax 33 04 78 43 26 58

Germany

Datex-Ohmeda GmbH
Langemarckplatz 3
D-91054 Erlangen
Germany
Tel 49 91 31 81 01 10
Fax 49 91 31 81 01 77

Datex-Ohmeda GmbH
Davis-Ricardo-Strasse 14
D-28832 Achim
Germany
Tel 49 421 48 64 211
Fax 49 421 48 64 236

Italy

Datex-Ohmeda S. p. A.
Via Cassanese 100
20090 Segrate
Milan
Italy
Tel 39 2 21693431
Fax 39 2 26926226

Netherlands

Datex-Ohmeda B. V.
Kantemarsweg 18
Post Box 22
3870 CA Hoevelaken
Netherlands
Tel 31 33 253 5404
Fax 31 33 253 7223

Spain

Datex-Ohmeda S. A.
C/Manuel Tovar 26
28034 Madrid
Spain
Tel 34 1 334 26 00
Fax 34 1 358 12 84

United Kingdom

Datex-Ohmeda Ltd.
Ohmeda House
71 Great North Road
Hatfield Hertfordshire
AL9 5EN England
Tel 44 1707 263570
Fax 44 1707 260191
Telex 915128

Latin America, Caribbean

Datex-Ohmeda Latin America
Regional Office
10685 N. Kendall Drive
Miami Florida 33176
USA
Tel 305 273 9940
Fax 305 273 4382

Middle East

Datex-Ohmeda
Middle East Operations
PO Box 5527
Dubai
United Arab Emirates
Tel 97 14 822653
Fax 97 14 822659

North America

Canada

Datex-Ohmeda (Canada) In
1093 Meyerside Drive, Unit 2
Mississauga, Ontario
L5T 1J6
Canada
Tel 800 268 1472
Fax 905 565 8592

United States

Customer Service
Datex-Ohmeda
Ohmeda Drive
PO Box 7550
Madison WI 53707-7550
USA
Tel 800 345 2700
Fax 608 221 4384

Technical Support
Datex-Ohmeda
Ohmeda Drive
PO Box 7550
Madison WI 53707-7550
USA
Tel 800 345 2755
Fax 608 223 2474

Sales
Datex-Ohmeda
Three Highwood Drive
Tewksbury MA 01876
USA
Tel 800 635-6099
Fax 978 640 0469

Service and Distribution Center
Datex-Ohmeda
7750 The Bluffs NW
Austell GA 30168-7754
USA
Tel 800 345 2755
Tel 770 739 4774
Fax 770 739 4770